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# Demographic and Clinical Profiles of Patients with Intracranial Neoplastic Mass Detected in Magnetic Resonance Imaging: A Retrospective Study

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## Abstract

**Introduction:** Brain tumor account for 85% to 90% of all primary central nervous system (CNS) tumors. It is common in children and elderly. Rest account for secondary brain tumor (metastasis). It is more common in adults. Brain tumor is the 10<sup>th</sup> leading cause of death for both men and women in US.

**Objective:** To know the demographic and clinical profile of patients with intracranial neoplastic mass at Indira Gandhi Institute of Medical Sciences (IGIMS), a tertiary care hospital of Bihar.

**Materials and Methods:** It is a retrospective study and done over a period of four months, from mid December 2016 to April 2017, in the department of Radio diagnosis at IGIMS.

**Result:** Majority of the patients were found in the 4<sup>th</sup> decade. Glioma was the most common brain tumor followed by meningioma. There was no definite lobar predilection. Males were affected more as compared to females.

**Conclusion:** MRI remains the first line investigation for the diagnosis and evaluation of intracranial masses in pre and postoperative period with reasonable degree of diagnostic accuracy. With the advent of newer modification of MRI such as MR venography, MR spectroscopy and MR perfusion etc. diagnostic accuracy has been increased.

**Key words:** Demographic profile, Intracranial tumor, MRI

## INTRODUCTION

A brain tumor or intracranial neoplasm occurs due to uncontrolled abnormal cell proliferation. It is of two types 1) benign and 2) malignant. Depending upon the site of origin it is again of two types 1) primary and 2) secondary. Depending upon the cell origin, it is of two types 1) glial origin and non-glial origin.

All types of brain tumor produce symptoms. Symptoms vary depending upon the area of the brain involved. Symptoms include headache, seizure, visual disturbance,

vomiting and behavioral changes etc. MRI has been considered to be gold standard for the pre-operative diagnosis, local staging and post-therapeutic (post surgery as well as post radiotherapy) monitoring for brain tumors.

Advantages of MRI over computed tomography (CT) scan are 1) to know the nature of the lesion, 2) to know whether focal or infiltrative mass 3) assessment of the residual or recurrence of the mass lesion. Many more lesions are picked up in MRI that is not visible on CT scan. Glioma is the most frequent primary brain tumor in adults, they account for 70% of adult primary brain tumor.

## MATERIALS AND METHODS

This study is a retrospective, single institutional study, which was conducted during a period of 20<sup>th</sup> December 2016 to 30 April 2017 (four months approximately).

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This study has been approved by the ethical committee of this institute. A total of 84 patients with intracranial neoplastic masses were included in this study. Patients with all the ages and both the sexes were included in this study. Post-treated cases were not included.

The MR scanning was performed on GE optima MR 360, 1.5T MRI machine. Images were taken in axial plane with 15 degree angulation of the gantry to the cantho-meatal line, after selecting proper field of view and localizer. Slices were taken without overlapping cuts with slice thickness 3-5 mm. Coronal as well as

sagittal sections were taken in all cases for the accurate determination of anatomical location and extension of the lesion.

Routine sequences included fast spin echo (FSE) T1 weighted images, T2 weighted images, fluid attenuated inversion recovery (FLAIR), gradient recalled echo (GRE), diffusion weighted images (DWI), and MR spectroscopy (MRS). Contrast studies were performed in all the patients. 10 cc of intravenous Magnilek (Gadopentate Dimeglumine) was given for contrast enhancement on T1 weighted images.

Patients from the neurology and emergency department of this institute were included in the study whose MRI shows intracranial neoplastic mass. Written and informed consent were taken from all the participants. A semi-structured questionnaire was prepared. Demographic and clinical data like age, sex and clinical symptoms like headache, vomiting, visual and gait disturbances etc were recorded.

**Table 1: MRI brain reviewed**

Sl. No.	Month	No. of brain scan	No. of brain tumor
1	December 2016	60	2
2	January 2017	243	16
3	February 2017	270	32
4	March 2017	305	14
5	April 2017	286	20
	Total	Total - 1164	84

**Table 2: Age group of the patient**

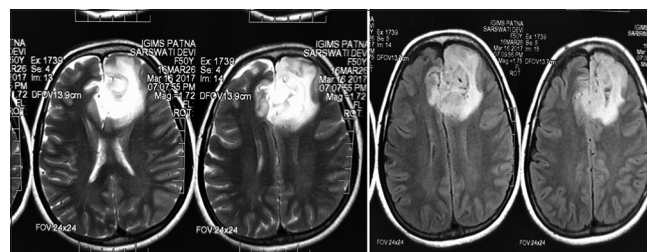
Sl. No.	Age group (in Years)	No. of patients (%)
1	1-10	4 (4.76)
2	11-20	7 (8.33)
3	21-30	15 (17.86)
4	31-40	17 (20.24)
5	41-50	15 (17.86)
6	51-60	15 (17.86)
7	61-70	10 (11.9)
8	>70	1 (1.19)
	Total	Total - 84

**Table 3: Sex distribution**

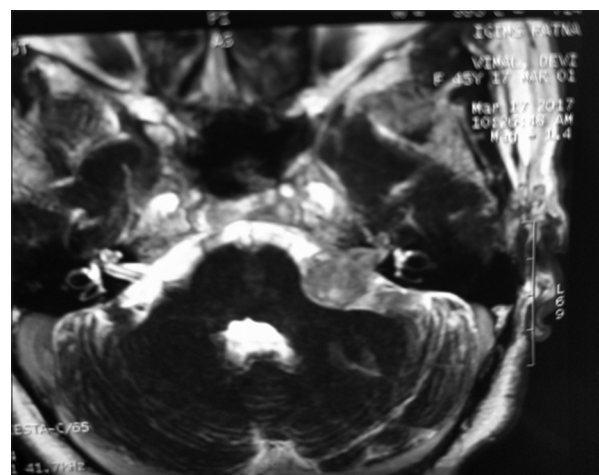
Sl.no.	Sex	No. of patients (%)
1	Female	33(39.29)
2	Male	51(60.71)
	Total	Total - 84

**Table 4: Clinical presentation**

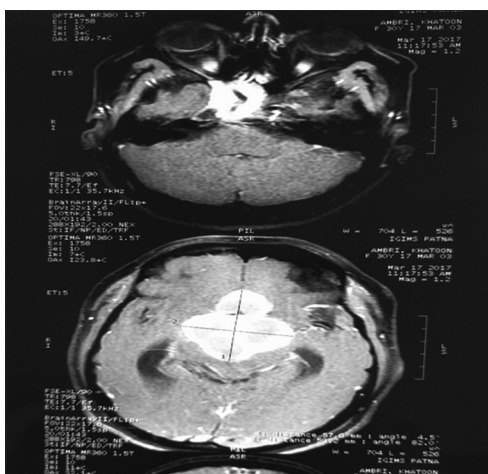
Sl. No.	Symptoms	No. of patients (%)
1	Headache	52(61.90)
2	Vomiting	28(33.33)
3	Vertigo	22(26.19)
4	Visual disturbances	16(19.05)
5	Giddiness	12(14.29)
6	Paralysis	11(13.10)
7	Seizure	11(13.10)
8	Fall	5(5.95)
9	Gait disturbances	5(5.95)
10	Loss of appetite	5(5.95)
11	Fever	4(4.76)
12	Loss of memory	4(4.76)



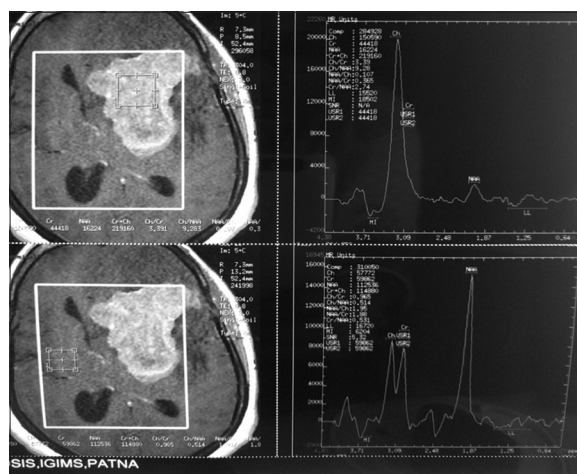
**Figure 1: (a) T2WI and (b) FLAIR sequences show hyperintense mass lesion in the left frontal lobe with extension into the right frontal lobe associated with moderate amount of perilesional edema and mass-effect (effaced) over the both frontal horn – glioblastoma multiformis**



**Figure 2: FIESTA sequence shows well-defined round shaped hyperintense mass lesion at the left cerebellopontine angle with widening of the internal auditory canal – vestibular schwannoma**



**Figure 3: CEMRI (contrast enhanced MRI) shows well defined homogenous enhancing mass lesion in the sellar and suprasellar region extrinsically compressing the anterior commissure of the 3rd ventricle leading to dilatation of both lateral ventricle – pituitary macroadenoma**



**Figure 4: CEMRI with MRS (MR spectroscopy) shows multilobulated homogenous enhancing mass in the left parietal lobe with effaced ipsilateral lateral ventricle with elevated choline peak**

## DISCUSSION

A total of 1164 patients were underwent MRI brain. Among these 84 (7.22%) patients, MRI brain revealed presence of intracranial neoplastic mass.

Age of the patient ranges from 2-75 years. The mean age was 41.11 year.

The maximum number of patients was in 4<sup>th</sup> decade, comprising 20.24% cases, and were followed by 3<sup>rd</sup>, 5<sup>th</sup> and 6<sup>th</sup> decade comprising 17.86% each. In a similar study by B.R. Goyani<sup>1</sup>, maximum number of patients was in 4<sup>th</sup> decade (28.5%) followed by 5<sup>th</sup> decade (18.5%). While according to K.Mahesh<sup>2</sup>, maximum number of patient was

**Table 5a: Mass distribution**

Location	No. of patients(%)
Intra-axial	63(75)
Extra-axial	21(25)

**Table 5b: Mass distribution**

Location	Lobar involvement	No. of patients (%)
Intra-axial mass	Frontal lobe	14(16.67)
	Temporal lobe	12(14.29)
	Parietal lobe	5(5.95)
	Occipital lobe	5(5.95)
	Multiple lobe	18(21.43)
	Brain stem	2(2.38)
	Posterior fossa	7(8.33)
Extra-axial mass	Sellar and suprasellar	9(10.72)
	Cerebello-pontine angle	7(8.33)
	Others - Cerebral convexity and base of skull	5(5.95)

**Table 6: MRI findings**

Sl. No.	Disease	No. of cases (%)
1	Glioma	27(32.14)
2	Meningioma	16(19.04)
3	Metastasis	13(15.48)
4	Sellar & suprasellar mass	7(8.33)
5	Schwannoma	5(5.95)
6	Ependymoma	4(4.76)
7	Medulloblastoma	4(4.76)
8	Glioblastoma multiformis	3(3.57)
9	Metastasis	3(3.57)
10	Hemangioblastoma	1(1.20)
11	Ganglioglioma	1(1.20)

in 6<sup>th</sup> decade (36%). Where as by B.Shah et al<sup>3</sup> maximum number of patient were in 1<sup>st</sup> decade (21%) followed by 4<sup>th</sup> decade (18%).

The sex ratio of the present study was found to be quite comparable with study conducted by B.R.Goyani<sup>1</sup>, K.Mahesh<sup>2</sup>, etc. Male preponderance was observed in all studies.

Headache (61.90%) was most common presenting complaint in our study followed by vomiting (33.33%) and then vertigo (26.19). In study of B.R.Goyani<sup>1</sup>, headache (51.42%) was most common symptom followed by seizure (32.85%). However in study by K.Mahesh<sup>2</sup>, convulsions (50%) was the most frequent symptom followed by headache (40%).

Intra-axial neoplastic mass were much more common than the extra-axial neoplastic mass in this study<sup>4</sup>.



Among the intra-axial mass, Glioma was the most common tumor followed by metastasis. Among the extra-axial mass, meningioma was the most common tumor and is followed by Sellar and supra-sellar mass. Meningioma was the most common extra-axial intracranial neoplasm and they account for the 15-10 % of intracranial neoplasm<sup>6</sup>.

There was no definite lobar predilection for the neoplastic mass, but multiple lobe (21.43 %) involvement was found to be more common [Tables 1-6 and Figures 1-4].

## CONCLUSION

Brain tumor is more common in 4<sup>th</sup> decade. Males are affected much more than the females. Headache is

the most common presenting symptoms followed by vomiting.

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# Effect of Pre-operative Finasteride Therapy on Perioperative Blood Loss in Transurethral Resection of Prostate for Benign Prostatic Hyperplasia-A Prospective Randomized Study

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## Abstract

**Background:** Benign prostatic hyperplasia (BPH) is the common benign tumor in men more than 50 years of age. 5 $\alpha$ -reductase inhibitors such as finasteride and dutasteride are commonly used in the medical management of BPH due to its prostatic volume reduction properties secondary to inhibition of the androgen dihydrotestosterone. Studies have reported that short course of pre-operative finasteride reduces perioperative blood loss following transurethral resection of prostate (TURP) for BPH. However, this is not practiced widely. Therefore, we conducted this study to evaluate the effect of finasteride on intraoperative and post-operative blood loss following TURP, which could resolve some of the controversies over the use of this drug.

**Materials and Methods:** One hundred patients undergoing TURP for BPH were randomly allocated into two groups with 50 patients in each group. Group A patients received tablet finasteride 5 mg once a day 2 weeks before surgery and Group B patients received only placebo. Intraoperative blood loss, post-operative hemoglobin (HB), packed cell volume drops and operative time, resected tissue weight and tissue microvessel density (MVD) were assessed. Post-operative follow-up was done at 1 month maximum urinary flow rate and international prostate symptom score score was assessed.

**Results:** The demographic parameters were comparable in two groups. The mean HB drop in Groups A and B was 1.7 and 2.8 g, respectively. The mean operative time and resected tissue weight in both Groups A and B were 46 min, 27.7 g and 53 min, 24.1 g, respectively. In finasteride group, there was a significant reduction of intraoperative blood loss, MVD, and post-operative complications such as clot retention, need for blood transfusion, and urinary tract infection.

**Conclusion:** Pre-operative short course finasteride therapy definitely reduces the perioperative blood loss following TURP for BPH.

**Key words:** Benign prostatic hyperplasia, Finasteride, Perioperative blood loss

## INTRODUCTION

Benign prostatic hyperplasia (BPH) is an abnormal stromal and glandular proliferation of the prostate gland.<sup>[1]</sup> BPH is

characterized by the proliferation of the prostatic epithelial and stromal cells within the prostatic transition zone, which results in enlargement of the prostate gland which in turn leads to compression of the prostatic urethra, and restriction of urinary flow.<sup>[2]</sup> The pathophysiology and etiology of BPH is multifactorial, and they are yet to be known.<sup>[3]</sup> However, the proliferation of prostatic stromal cells is dependent on androgens, the most important being dihydrotestosterone.<sup>[3]</sup> Management of patients with BPH is based on the clinical symptoms and complications associated with BPH.<sup>[4]</sup> Although transurethral resection of prostate (TURP) is considered the worldwide accepted gold

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standard tool in the management of BPH,<sup>[5]</sup> it is associated with significant complications such as intraoperative and perioperative bleeding, which may be life-threatening.<sup>[6]</sup> There have been few studies that have suggested the 5 $\alpha$ -reductase inhibitors finasteride and dutasteride to have anti-angiogenic properties and cause reduction of intraprostatic and suburethral microvessel density (MVD)<sup>[7]</sup> that may reduce blood loss following TURP. Even though several studies have shown that pre-operative short course of finasteride for BPH reduces perioperative blood loss following TURP, this is not practised routinely. The goal of this study is to evaluate the effect of finasteride on intraoperative and post-operative blood loss following TURP, which could resolve some of the controversies over the use of this drug.

## MATERIALS AND METHODS

In this randomized double-blind placebo-controlled study, approved by the Institutional Ethical Committee, we included 100 patients (50 patients in each group) who underwent TURP for symptomatic BPH in Sri Ramachandra Medical College and Research Centre from August 2016 to June 2017. Exclusion criteria were including prior prostatic surgery, prostatic carcinoma and patients with bleeding disorders or those were on anticoagulants. These patients were randomized into Groups A and B. In Group A, patients received 2 weeks of Tablet finasteride 5 mg once a day dose before surgery. In Group B patients received only placebo. The surgeon and the patients were blinded to the nature of pre-operative therapy. Surgery was performed only by the experienced senior consultants. Pre-operative hemoglobin (HB), and hematocrit were checked. Operating time, need for intraoperative and post-operative blood transfusion and resected prostatic tissue weight were assessed.

### Statistical Analysis

Results were analyzed using student *t*-test with  $P < 0.05$  considered to indicate statistical significance.

## RESULTS

All 100 patients who were randomized into Groups A and B underwent TURP. There was no difference in baseline characteristics (age, prostate volume HB, and hematocrit) between two groups. After TURP a mean decrease of HB and hematocrit in Group A was 1.7 g and 1.9% and in Group B was 2.8 g and 3.5%, respectively. Mean operating time and resected prostatic weight in Groups A and B were 47 min and 28 g and 53 min and 24 g, respectively. Post-operative maximum urine flow rate in Groups A and B was 14.2 ml and 13.1 ml. 3 patients in Group A and 6 patients in Group B had clot retention required clot evacuation.

The calculated intraoperative blood loss in Groups A and B 175 ml and 220 ml, respectively. 2 patients in Group A and 6 patients Group B required post-operative blood transfusion. The mean MVD of resected prostatic tissue from Groups A and B was 14 and 18 units, respectively [Table 1].

## DISCUSSION

Intra- and post-operative bleeding is one of the major dreaded complication following TURP. 5 $\alpha$ -reductase inhibitors such as finasteride and dutasteride have anti-angiogenic properties. This has been analyzed in recent randomized trials. One meta-analysis reported that finasteride effectively controls perioperative blood loss following TURP.<sup>[8,9]</sup> However, their data lacks sufficient details regarding their analysis of the anti-angiogenic properties of finasteride. The primary aim of this randomized, double-blind, placebo-controlled study was to assess whether pre-treatment with finasteride reduces the blood loss during TURP. In our study, patients on short course pre-operative finasteride group have a significant reduction in post-operative blood loss and operating time and reduced MVD in resected prostatic chips. Hence, finasteride has anti-angiogenic properties that indirectly reduce prostatic vascularity. Few studies have also reported that finasteride inhibits the vascular endothelial growth factor-the vascular growth factor.<sup>[7,10]</sup> Furthermore, patients on finasteride group have a significant reduction in pre-operative prostate size that contributes to less blood loss following TURP. Due to less bleeding in finasteride group that gives better optics to the operating surgeon and that may be the reason for less resection time. In our study finasteride group, patients had significant improvement

**Table 1: Comparison of Group A and Group B**

Parameters	Group A	Group B	P
Post-operative HB loss	(11.7–10=1.7 g)	(12.2–9.4=2.8 g)	0.000
Resection time	46 min	52.8 min	0.002
Resected tissue weight	27.7 g	24.1	P=0.024
Intraoperative blood loss	175 ml	220 ml	P=0.000
Post-operative IPSS	Mild (0–7)-94%	Mild (0–7)-88%	P=0.034
MVD	18.04	24.3	P=0.03
Persistent hematuria	2%	6%	
Blood transfusion	4%	12%	Significant
Clot retention	6%	18%	Significant
USG-weight loss	45.6–18.3=27.3 g	45.6–19.9=25.7 g	P=0.054
UTI with culture positive	6%	12%	-
Failure to void	6%	10%	Significant

$P < 0.05$  is significant. HB: Hemoglobin, IPSS: International prostate symptom score, MVD: Microvessel density, USG: Ultrasonography, UTI: Urinary tract infection

in post-operative Q max and a significant reduction in international prostate symptom score during follow-up.

## CONCLUSION

From our study, we conclude that pre-operative short course of finasteride therapy (Tablet finasteride 5 mg OD) definitely reduces the perioperative complications such as intra- and post-operative blood loss, persistent hematuria, need for blood transfusions, clot retention, and post-operative voiding failure. It also decreases operative time, tissue MVD, and post-operative urinary tract infection. It aids removal of more prostatic tissue and also improves the urinary flow rate (Q max). However, we need larger studies and meta-analysis to suggest stronger recommendations regarding the definite use of finasteride before TURP in the treatment of BPH.

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# Magnetic Resonance Imaging Brain in Evaluation of Pediatric Epilepsy

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## Abstract

**Introduction:** About 5% children are at risk of experiencing a seizure and half of them encounter the first seizure in infancy. Epilepsy is a condition in which seizures are triggered recurrently from within. Electroencephalograph and neurosonogram are often the initial diagnostic workup for seizure activity. They have the benefits of being non-invasive and avoiding radiation exposure. Computed tomography is helpful in detection of calcific foci; however, it has the risk of radiation exposure. Magnetic resonance imaging (MRI) is the imaging modality of choice due to its ability to depict neuroanatomy, excellent gray white matter differentiation, status of myelination and detection of focal structural brain lesions.

**Purpose:** The aim of study was to detect and characterize various lesions causing epilepsy in pediatric age group (0–12 years) and also to detect frequency with which they occurred using MRI.

**Methods:** The study was performed on 95 children under the age of 12 years over a period of 2 years who presented with epilepsy. Patients with trauma and febrile seizure disorders were excluded. Conventional and contrast MRI was performed in all cases and lesions were characterized in location, signal intensity, and other features.

**Results:** The mean age group of the study population was 4 years 3 months. Generalized seizures constituted the major seizure group being present in 66.3%. Our study shows infection (29.8%) as the most common etiology followed by anoxia and hypoxic-ischemic encephalopathy. Mesial temporal sclerosis (57.1%) was the most common pathology seen in isolated temporal lobe epilepsy. Demyelinating diseases and neoplasm constituted 3.6% patients each.

**Conclusion:** MRI is the imaging modality of choice in the evaluation of pediatric patients presenting with epilepsy. Proper MRI seizure protocol helps to establish the correct diagnosis, plan the management according to diagnosis as well as helps in prognosis.

**Key words:** Brain, Epilepsy, Magnetic resonance imaging, Pediatric

## INTRODUCTION

A seizure is defined as a sudden, paroxysmal electrical discharge from the central nervous system (CNS) resulting in involuntary motor, sensory or autonomic disturbances with or without alteration in sensorium.<sup>[1]</sup> The age and neurodevelopmental maturity status determine the clinical manifestation and type of seizure disorder. About 5%

children are at risk of experiencing a seizure and half of them encounter the first seizure in infancy. Prevalence is greater in the neonatal period (almost 1% in term and 20% in preterm). In infancy, febrile convulsions are the most frequent form.<sup>[1]</sup> Epilepsy is a condition in which seizures are triggered recurrently from within. It is considered to be present when two or more unprovoked seizures occur at an interval >24 h apart. The cumulative lifetime incidence of epilepsy is 3%, and more than half the cases begin in childhood. The annual prevalence of epilepsy is lower (0.5–0.8%) because many children outgrow epilepsy.<sup>[2]</sup> Children with epilepsy should undergo neuroimaging if one or more of the following indications are present:

- a. If there is any evidence to suggest that epilepsy is localization-related (e.g. focal), with the exception of typical benign idiopathic partial epilepsy. The basis

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for establishing localization-related seizures includes the characteristics of the seizure, abnormalities on an electroencephalograph (EEG), focal examination (including Todd's paralysis), and history or examination to suggest remote symptomatic cause (such as extreme prematurity, meningitis, encephalitis, complicated febrile convulsion, or significant head injury).

- b. Abnormal neurologic examination including focal deficits, stigmata of neurocutaneous, cerebral malformation syndrome, or a history of significant developmental delay, arrest, or regression.
- c. Children younger than 2 years, excluding those with simple febrile seizures.
- d. Children with characteristics of a symptomatic generalized epilepsy syndrome, including infantile spasms or early Lennox-Gastaut syndrome.
- e. Failure to control seizures, worsening seizures, changes in seizure manifestations, or developmental regressions also merit neuroimaging if not previously performed.
- f. Finally, new-onset seizures/epilepsy presenting with evidence for a medical emergency such as increased intracranial pressure or status epilepticus always merit emergency imaging.<sup>[3]</sup>

The EEG is helpful when it is clearly abnormal but 40–50% of patients with epilepsy have a normal single interictal EEG. On the other hand, about 5% of non-epileptic patients may have non-specific EEG abnormalities. Despite its limitations, the EEG is a simple non-invasive and relatively inexpensive test that gives useful information if used judiciously and correlated with the clinical description of seizures. When abnormal, it is helpful in making a correct diagnosis of epilepsy and may even help in the choice of anti-epileptic drug therapy in a given case. Ultrasound is often the initial study in a diagnostic workup for seizure activity. It has the benefits of being non-invasive and avoiding radiation exposure. Neonatal head ultrasound's primary role has traditionally been in the evaluation of the preterm newborn for diagnosis of parenchymal hemorrhage, germinal matrix hemorrhage, and hydrocephalus. Ultrasound may detect changes of hypoxic-ischemic injury, vascular anomalies, or brain malformations.<sup>[4]</sup> Computed tomography (CT) is helpful in the identification of intracranial hemorrhage, major vascular malformations, and ventriculomegaly. The sensitivity of CT is approximately 30% in the detection of many of the causes of epilepsy. Given these limitations, as well as the risks of radiation exposure in infants and young children, CT has been replaced by magnetic resonance imaging (MRI) in the elective workup of childhood epilepsy.<sup>[4]</sup> MRI is the imaging modality of choice due to its ability to depict neuroanatomy, excellent gray white matter differentiation, status of myelination and detection of focal structural brain lesions.<sup>[2]</sup> MRI is the technique of choice

to identify underlying cause in partial seizures. Even when enhanced MRI has been compared with contrast enhanced CT; the superiority of MRI is seen especially in temporal lobe origin, since lesions in inferior temporal lobes may be inapparent on CT scan due to beam hardening artifacts. The accuracy of cranial MRI diagnosis has been improved by the introduction of paramagnetic contrast agent gadopentetate dimeglumine. It increases the detection rate of certain intracranial lesions especially those of vascular nature and those involving the meninges. It significantly improves radiologic specificity particularly with regard to defining the extent or nature of certain neoplasms and the differentiation of aggressive from benign processes. Coregistration of MRI with other functional imaging modalities such as positron emission tomography and single-photon emission CT have also been proven valuable in localization of structural and functional alteration.<sup>[5]</sup> The role of MRI in epilepsy surgery in identifying the epileptogenic focus also lies in its ability to depict topographic relationships between epileptogenic lesion and the eloquent regions of the brain.<sup>[5]</sup> Post-operative MRI may detect causes of failure such as inadequate resection and can monitor tumor recurrence on follow-up imaging.<sup>[5]</sup> MRI is especially useful for prognosticating post-operative seizure control. This study proposes to evaluate the role of MRI in detection and characterization of causes and their frequency for pediatric epilepsy and to assess its diagnostic utility.

### Aims and Objectives

To detect and characterize the lesions causing epilepsy in pediatric age group (0–12 years) and to detect the frequency of etiological factors responsible for epilepsy using MRI.

## MATERIAL AND METHODS

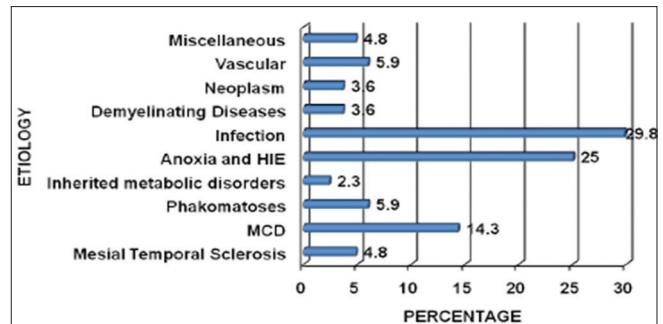
A hospital based prospective time bound clinical study was carried out in a Tertiary Care Centre over a duration of 2 years. The sample size was 95. All pediatric patients (age under 12 years) referred from outpatient department and inpatient department who presented with epilepsy were included. Patients with metallic implants, claustrophobia, trauma, and febrile seizure disorders were excluded. All patients were subjected to MRI using Philips Achieva 1.5 Tesla machine. Conventional MRI was performed by taking T1W (TE 8.0 ms, TR 480 ms), T2W (TE 102.9 ms, TR 4780 ms), and fluid-attenuated inversion recovery (FLAIR) (TE 92.2 ms, TR 8002 ms) sequences. Post-gadolinium (dose 0.1 mmol/kg) enhanced MRI was performed in axial and sagittal planes in selected cases depending on findings on non-contrast study or clinical suspicion. Diffusion-weighted imaging (TE 83 ms, TR 5025 ms) and gradient recalled echo axial performed in all cases. When required,



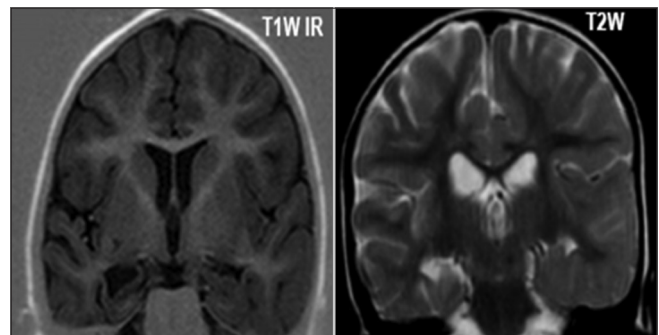
MR spectroscopy, venous 3-dimensional phase contrast angiography and MR angiography including time of flight were done. MRI was assessed for any possible neurological causative lesion of seizures. Lesions were characterized in location, signal intensity and other features seen on different MRI sequences. Statistical analysis - data were collected and entered into MS Excel. Statistical calculations were made, and results of this study were analyzed and compared with other available studies in literature. Findings of EEG and CT scan if done were documented and correlated with imaging findings. Final diagnosis was based on the medical history, clinical presentation, EEG and CT correlation, follow-up cerebrospinal fluid analysis, pathological, surgical findings when available and response to medical therapy. In inconclusive cases, it was made by follow-up MRI and treatment response. Ethical clearance was obtained from the Ethical Committee of the Institution for this study.

## RESULTS

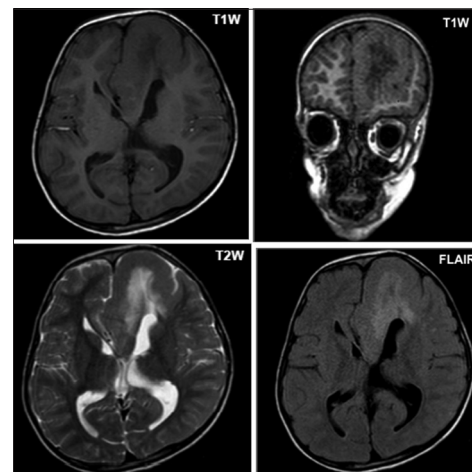
Out of 95 patients, 63 patients (66.3%) presented with generalized seizures, 21 patients (22.1%) presented with focal seizures while 11 patients (11.6%) had an unknown onset. 84 patients (88.4%) had positive findings on MRI while 11 patients (11.6%) had normal MRI with no detectable lesions. Most of the patients in the study were in the age group of 0–3 years followed by 10–12 years. There was a male preponderance with male:female ratio of 2.1:1. Infection comprised 25 patients (29.8%), followed by anoxia and hypoxic-ischemic encephalopathy (HIE) in 21 patients (25.0%). Malformations of cortical development (MCD) were seen next in 12 patients (14.3%). Phakomatoses and vascular causes constituted 5 patients each (5.9%). Mesial temporal sclerosis (MTS) and miscellaneous causes constituted 4 patients each (4.8%). Demyelinating diseases and neoplasm were seen in 3 patients each (3.6%). Least common were inherited metabolic disorders comprising 2 patients (2.4%). Thus, most common etiology in our study was infection followed by anoxia and HIE [Figure 1]. Only temporal lobe was affected in 7 patients causing isolated temporal lobe epilepsy. Out of them, MTS was most frequently seen in 4 patients (57.1%). Focal cortical dysplasia (FCD), dysembryoplastic neuroepithelial tumors (DNET), and tuberculosis (TB) with tuberculomas constituted the remainder with 1 patients each (14.3%). All 4 patients of MTS showed the presence of hippocampal atrophy and secondary changes (temporal horn dilatation). Loss of hippocampal architecture was present in 3 patients (75%) and hippocampal T2, FLAIR hyperintensity was present in 2 patients (50%) [Figure 2]. MCD constituted 12 patients presenting with epilepsy. Out of them, FCD [Figure 3] was seen in 4 patients (33.3%). Corpus callosal



**Figure 1: Most common etiology in our study was infection comprising 25 patients (29.8%) followed by anoxia, hypoxic-ischemic encephalopathy in 21 patients (25.0%)**



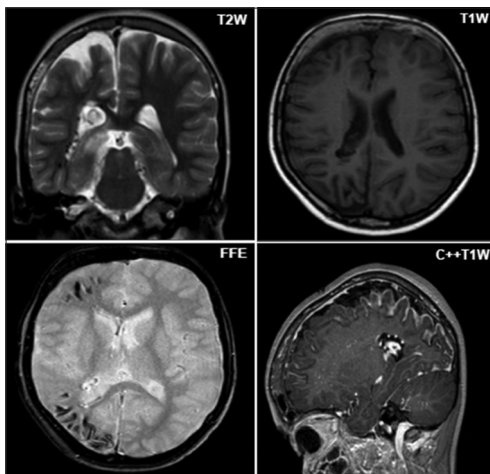
**Figure 2: Mesial temporal sclerosis: T1W IR image reveals atrophy of right hippocampus with dilated temporal horn. T2W image reveals abnormal hyperintensity of right hippocampus. Mesial temporal sclerosis is an uncommon finding in children, but when it occurs, it is always associated with epilepsy**



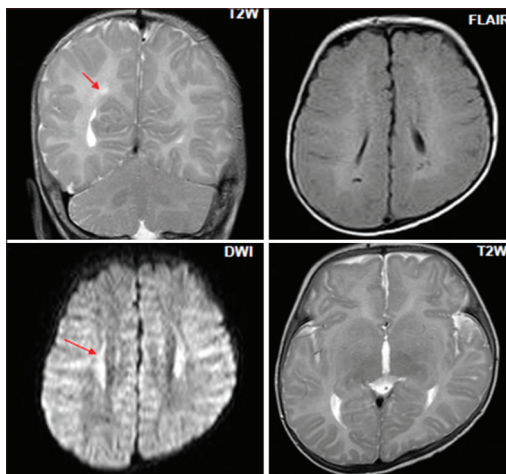
**Figure 3: Focal cortical dysplasia: T1W image shows cortical thickening of the left frontal lobe with blurred gray white matter interface and hypointense underlying white matter. T2W and fluid-attenuated inversion recovery image reveals similar findings with hyperintense white matter**

dygenesis/agenesis (CCD/CCA) and polymicrogyria constituted 3 patients (25.0%) each. Pachygyria constituted 2 patients (16.5%) while microcephaly with simplified gyral pattern, heterotopia, hemimegalencephaly (HMEG), and holoprosencephaly (HP) (lobar) constituted the remainder

with 1 patient (8.3%) each. Four patients had multiple pathologies. One had pachygyria with HMEG. Other 3 patients had pachygyria with polymicrogyria, CCD/CCA with HP (lobar), and FCD with polymicrogyria, respectively. Out of 5 patients with phakomatoses, 3 patients (60.0%) had tuberous sclerosis (TS). Sturge-Weber syndrome (SWS) and neurofibromatosis 1 (NF1) were seen in 1 patient (20.0%) each [Figure 4]. Out of 2 patients with inherited metabolic disorders, MELAS and metachromatic leukodystrophy constituted 1 patient (50%) each. Anoxia and HIE were the cause of epilepsy in 21 patients in our study. Out of them, 12 patients (57.2%) and 9 patients (42.8%) were preterm and term, respectively, based on the clinical information elicited [Figure 5]. Among



**Figure 4: Sturge-Weber syndrome: T2W images show right cerebral hemiatrophy, ipsilateral calvarial thickening, and prominent choroidal vessels. Gradient-recalled echo shows blooming s/o gyral calcifications with prominent serpentine leptomeningeal enhancement on post-contrast image**



**Figure 5: Hypoxic-ischemic encephalopathy in a preterm. T2W images show periventricular cerebrospinal fluid attenuation lesions which are suppressed on fluid-attenuated inversion recovery images. Diffusion-weighted imaging reveals restricted diffusion in these lesions**

the neuroimaging findings, leukomalacia was the most common finding seen in 11 patients (52.4%) followed by cystic changes seen in 8 patients (38.0%). White matter volume loss was next common seen in 7 patients (33.3%), and intracranial hemorrhage was seen only in 1 patient (4.7%). In our study, the cause of seizures in 25 patients was infectious etiology. TB was seen in 7 patients (28.0%), neurocysticercosis in 6 patients (24.0%), encephalitis in 5 patients (20.0%), meningoencephalitis in 3 patients (12.0%), and pyogenic abscess in 2 patients (8.0%). Meningitis (excluding tuberculous), Subdural empyema, and Rasmussen's encephalitis constituted 1 patient (4.0%) each. One patient had both meningoencephalitis with pyogenic abscess. Thus, in our study, most common pathology in patients with infectious etiology was TB followed by neurocysticercosis [Figures 6 and 7]. Out of 7 patients found to have TB, 5 patients (71.4%) had tuberculomas. 4 patients (57.1%) demonstrated leptomeningeal enhancement and 2 patients (28.6%) had infarcts. 1 patient (14.3%) had tuberculous abscess. Communicating hydrocephalus was associated only in 1 patient (14.3%). None of the patient showed cranial nerve involvement (CNI). Neoplasm comprised 3 patients in our study. DNET, hypothalamic hamartoma, and choroid plexus papilloma were seen in 1 patient (33.3%) each [Figure 8]. Vascular etiology was responsible for seizures in 5 patients. 3 (60.0%) of them had arterial infarcts (excluding tuberculous), 1 (20.0%) had arteriovenous malformation while another patient (20.0%) had cavernous angioma with a developmental venous anomaly [Figure 9]. None of the patient had venous infarct. Four patients were grouped under miscellaneous causes with postictal edema, aqueductal stenosis, arachnoid cyst, and idiopathic intracranial hypertension seen in 1 patient (25.0%) each.

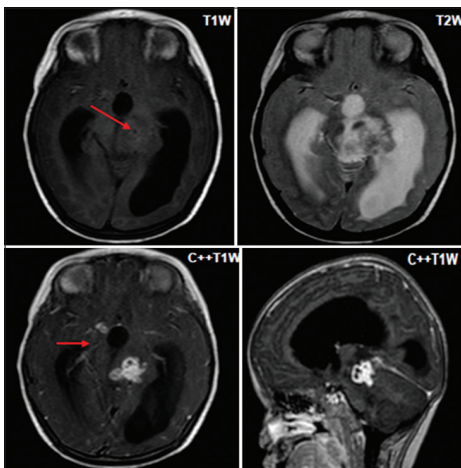
## DISCUSSION

In our study of total 95 patients, maximum (57.9%) were in the age group of 0–3 years. The mean age group of the study population was 4 years 3 months. Our study is in discordance with the study conducted by Gulati *et al.* in which maximum patients were in the age group 6–12 years.<sup>[6]</sup> It is also in discordance with the study conducted by Wongladarom *et al.* in which mean age group of the study population was 7 years and 5 months.<sup>[7]</sup> Male:female ratio in our study was 2.1:1 and correlates with the study conducted by Sanghvi *et al.* in which 60.5% were males and 31.7% were females.<sup>[8]</sup> Studies conducted by Gulati *et al.*, Amirsalari *et al.*, and Zajac *et al.* also showed similar findings in which males outnumber females.<sup>[6,9,10]</sup> Generalized seizures constituted the major seizure group being present in as many as 66.3% in our study and correlate with the study conducted by Chaurasia *et al.* in which it was seen in 76.7% patients.<sup>[11]</sup> 84 patients (88.4%)

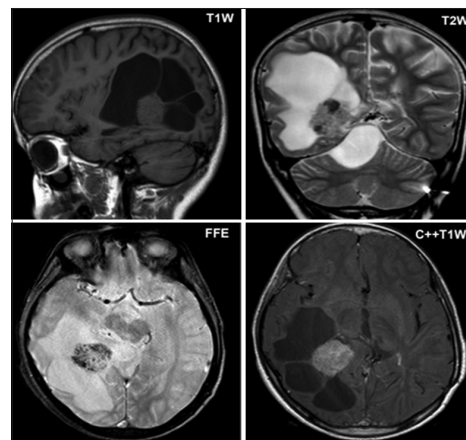


had abnormal MRI findings in our study. Kuzniecky *et al.* found MRI abnormalities in 84% of patients.<sup>[12]</sup> Our study is comparable with the studies of Chaurasia *et al.*, Gulati *et al.*, Kumar *et al.* and shows infection as the most common etiology in pediatric epilepsy.<sup>[11,13,14]</sup> This may be due to a higher prevalence of infection in developing countries like India. Infectious etiology was seen in 25 patients in which most common was TB found in 7 patients (28.0%), followed by neurocysticercosis in 6 patients (24%), encephalitis in 5 patients (20.0%), meningoencephalitis in 3 patients (12.0%), pyogenic abscess in 2 patients (8.0%), subdural empyema in 1 patient (4.0%), and Rasmussen's encephalitis in 1 patient (4.0%). In Gulati *et al.* study, out of 158 patients with structural abnormalities on MRI, tuberculoma was

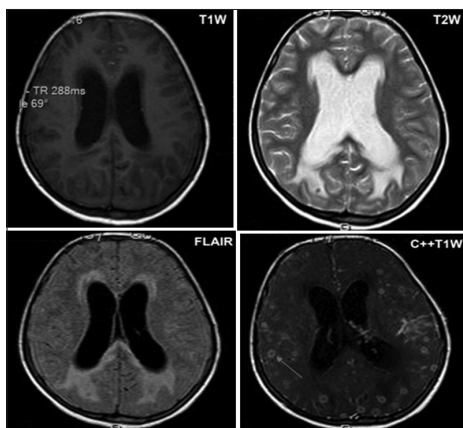
the most common lesion present in 40% followed by neurocysticercosis in 17%.<sup>[6]</sup> In a study by Chaurasia *et al.*, the most common cause of epilepsy was CNS TB (30.3%), followed by neurocysticercosis (11.0%) and encephalitis (7.9%).<sup>[11]</sup> Our study thus correlates with the above-mentioned studies. However, our study is in discordance with Kumar *et al.* study, in which most common etiology was neurocysticercosis (55.81%) followed by tuberculoma (29.91%).<sup>[14]</sup> 7 out of 84 patients (8.3%) had isolated temporal lobe involvement. MTS was most commonly seen in 57.1% of them. Our study correlates with study conducted by Grattan-Smith *et al.* in which MTS was seen in 30 out of 53 children (57%) of patients with temporal lobe epilepsy.<sup>[15]</sup> All 4 patients with MTS in our study showed



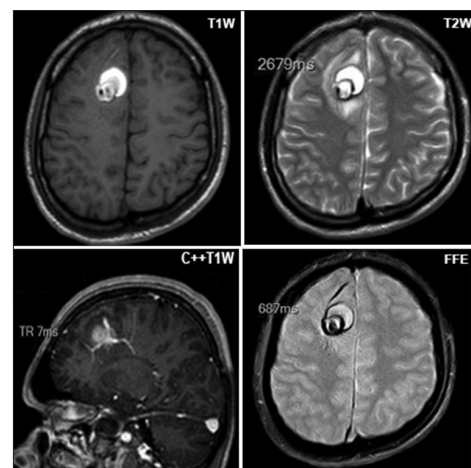
**Figure 6: Tuberculosis:** T1W images reveal well-defined hypointense lesions involving left thalamus and midbrain. T2W images reveal ill-defined hyperintensity with few hypointense foci. Postcontrast images reveal peripherally enhancing conglomerated lesions with associated abnormal meningeal enhancement and hydrocephalus



**Figure 8: Choroid plexus papilloma:** T1W, T2W images show cauliflower shaped isointense lesion arising from right lateral ventricle choroid plexus glomus causing its dilatation. Fast field echo axial images show multiple punctate foci of blooming. Post-contrast T1W axial image shows intense homogeneous contrast enhancement



**Figure 7: Neurocysticercosis:** T1W axial images show multiple well-defined lesions scattered throughout brain parenchyma appearing hypointense centrally and hyperintense peripherally. T2W and fluid-attenuated inversion recovery axial image shows hyperintense lesions with central hypointense dot and surrounding edema. Post-contrast axial image shows multiple ring-enhancing lesions (shown by arrow)



**Figure 9: Cavernoma with associated venous angioma:** T1W, T2W images reveal lobulated heterogeneous lesion in right frontal lobe with T2W hypointense rim. Gradient-recalled echo image shows peripheral and intralesional blooming. Post-contrast image shows serpiginous white matter veins draining into a central draining vein



hippocampal atrophy and secondary change (dilatation of temporal horn). Loss of hippocampal architecture was seen in 75% and hippocampal T2, FLAIR hyperintensity in 50% of patients. Our study is in discordance with Ng *et al.*, in which out of 24 patients with MTS, hippocampal T2 hyperintensity was seen in 20 patients (83.3%), hippocampal atrophy in 19 patients (79.2%), loss of hippocampal architecture in 13 patients (54.2%), and secondary change (decreased hippocampal T1-weighted signal) in 3 patients (12.5%).<sup>[16]</sup> There are significant differences as regards to the most frequent pathology in MCD in various studies published in literature. In our study, out of 12 patients having MCD, FCD was the most common in 4 patients (33.3%). Our study correlates with study conducted by Mittal *et al.*, in which out of 54 patients with MCD, FCD was the most common seen in 16 patients (29.6%), followed by schizencephaly in 8 (14.8%), polymicrogyria in 8 (14.8%), DNET in 6 (11.1%), and lissencephaly in 5 (9.3%).<sup>[17]</sup> Our study does not correlate with the study conducted by Sadek *et al.*, in which out of 50 patients with MCD, lissencephaly was most commonly found in 42% and FCD was seen in only 10% cases.<sup>[18]</sup> Another study conducted by Güngör *et al.*, who studied 101 patients with MCD, found polymicrogyria to be the most common in 53.4%.<sup>[19]</sup> Out of 5 patients of phakomatoses, 3 (60.0%) had TS, SWS was seen in 1 (20.0%), and NF1 (20.0%). Our study does not correlate with a study conducted by Dietrich *et al.*, in which neuroimaging study of 29 patients with medically intractable seizures was done.<sup>[20]</sup> The study included other studies than MRI for neuroimaging and neuro phakomatoses was the etiology in 5 (17.4%) patients. In the study, most common phakomatoses was SWS seen in 3 patients (60.0%), TS in 1 (20.0%), and NF1 (20.0%). In our study, only 2 patients had imaging findings of inherited metabolic disorders with MELAS seen in 1 patient (50.0%) and metachromatic leukodystrophy in another (50.0%) patient. No comparable data were available as to the most frequent pathology in inherited metabolic disorders causing pediatric epilepsy. In our study, anoxia and HIE were seen in 21 patients. 12 patients (57.2%) were preterm and 9 patients (42.8%) were term. Among the neuroimaging findings, most common was leukomalacia was seen in 11 patients (52.4%), followed by cystic changes in 8 patients (38.0%), white matter volume loss in 7 patients (33.3%), and intracranial hemorrhage in 1 patient (4.7%). Our study does not correlate with study conducted by Alam and Sahu, in which 45 children with history of perinatal asphyxia were studied with MRI.<sup>[21]</sup> Most common finding in this study was hemorrhage seen in 16 patients (35%) followed by periventricular leukomalacia in 13 patients (28.8%). This could be due to maximum cases of hemorrhage being diagnosed on ultrasound screening in patients with history of perinatal asphyxia in our department and thus less referral for MRI. Out of total 84 abnormal MRI, neoplasm

was seen in 3 (3.5%) patients. DNET, hypothalamic hamartoma, and choroid plexus papilloma were seen in 1 patient (33.3%) each. Our study is in concordance with Zajac *et al.* study, in which out of total 45 children studied, only 2 (4.4%) had brain tumors.<sup>[10]</sup> One patient had DNET and another patient had hypothalamic hamartoma; however, no patient of choroid plexus papilloma was seen in this study. In our study, neuroimaging findings were suggestive of vascular cause in 5 patients. Arterial infarcts (excluding tuberculous) were seen in 3 patients (60.0%), arteriovenous malformation in 1 patient (20.0%), and cavernous angioma with developmental venous anomaly in 1 patient (20.0%). Our study does not correlate with the study conducted by Wongladarom *et al.*, in which vascular disorder was responsible for epilepsy in 5 patients (5%).<sup>[7]</sup> Out of them, 2 patients (40%) had moyamoya disease, 1 patient (20%) had cavernous angioma, 1 patient (20%) had arteriovenous malformation, and the remaining 1 patient (20%) had bilateral carotid occlusion. Our study also does not correlate with Pilarska and Lemka study, in which out of 20 patients with cerebrovascular anomalies, the most common pathology was arteriovenous malformation found in 13 patients (65%).<sup>[22]</sup> For etiology in age group 0–3 years, our study correlates well with Khreisat study, in which children suffering from epilepsy below the age of 2 years were studied.<sup>[23]</sup> The most common etiological factor found in this study was perinatal asphyxia seen in 55%, followed by CNS infection in 15%, anomalies of CNS in (9%), head injuries in (8%), congenital and hereditary disorders in (8%), and prematurity in (5%). For etiology in older age group, our study correlates with Kumar *et al.* study, in which children in the age group of 28 days to 18 years with partial seizures were studied.<sup>[14]</sup>

6 patients (66.6%) in age group of 28 days – 5 years, 18 patients (85.7%) in age group of >5–10 years and 12 patients (92.3%) in age group >10–18 years had infection as the most common etiology. Thus infection had major burden in causing epilepsy with increasing age group. For etiology in older age group, our study also correlates with Gulati *et al.* study, in which 170 children with chronic seizures were studied.<sup>[6]</sup> Age distribution was done as follows: 0–1 year, 1–3 year, 3–6 year, and 6–12 year. The etiologies were classified into infections (tuberculomas, neurocysticercosis, and meningitis), atrophy, vascular, and miscellaneous causes. Infection was most common etiology in 6–12 years age group seen in 51.1%, followed by miscellaneous in 16.4%. In age group 0–1, 1–3, and 3–6 years, infection was seen in 4.7%, 4.1%, and 3%, respectively. This study had 4 patients with abnormal MRI grouped under miscellaneous cause. Postictal edema was seen in 1 patient (25.0%), aqueductal stenosis in 1 patient (25.0%), arachnoid cyst in 1 patient (25.0%), and idiopathic intracranial hypertension in 1 patient (25.0%). We found

3 patients showing imaging findings of demyelination in our study. One of them showed typical imaging findings of acute disseminated encephalomyelitis in 1 patient (33.3%). MRI findings of patchy hyperintense signal in bilateral corona radiata and centrum semiovale on T2W and FLAIR images, showing restricted diffusion with nodular enhancement on post-contrast T1W images was seen in 1 patient each (33.3%). No comparable studies were available as some of the published studies which we have gone through had discussed the above etiologies under a single heading. This study emphasizes the revolution brought about by MRI in evaluating pediatric epilepsies. The results of our study as regards to sex distribution, most common type of epilepsy and its correlation with MRI, distribution according to type of etiology, pathologies causing isolated temporal lobe epilepsy, neuroimaging findings in TB, distribution according to pathologies in MCD, infection, neoplasm and distribution according to various etiologies and age group are comparable with previous published studies in literature. However, the results are discordant with previous studies regarding age distribution, neuroimaging findings in MTS, anoxia and HIE, distribution according to pathologies in MCD, phakomatoses, and vascular cause. We could not find any comparable data mentioning the most frequent pathology in inherited metabolic disorders, demyelination and among miscellaneous causes.

## CONCLUSION

In the evaluation of pediatric patients with seizure disorder, it is important to arrive at an accurate diagnosis of cause of seizure for treatment decision. With its high spatial resolution, excellent inherent soft tissue contrast, multiplanar imaging capability and lack of ionizing radiation, and MRI have emerged as a versatile tool in imaging of pediatric patients with seizures. Employing appropriate imaging protocols and reviewing the images in systemic manner helps in the identification of subtle epileptogenic structural abnormalities. MRI could be the first investigation of choice in epileptic syndrome, developmental cortical malformations, and MTS. Its ability in identifying subtle lesions, location, and extent of the lesions is excellent. Hence, we conclude that MRI plays a significant role in the evaluation of pediatric patients presenting with epilepsy and it is the first imaging modality of choice with proper MRI seizure protocol to establish the correct diagnosis, plan the management according to diagnosis as well as helps in prognosis.

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# Effects of Topical Combinations of Parasympatholytic and Sympathomimetic Drugs among the Successful Post Dacryocystorhinostomy Patients - A Study

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## Abstract

**Purpose:** The purpose of our study was to assess the post-operative visual outcome after manual small incision cataract surgery in large scale for 1 year from April 2014 to March 2015.

**Materials and Methods:** A prospective study was conducted on 150 eyes of 75 patients of unilateral nasolacrimal duct obstruction at a tertiary hospital over a period of 2 years (2014–2016). The patients were selected from the out-patient department irrespective of their sex and religion. The age group of the study was 15–50 years. The unaffected eye served as control.

**Result:** The mean value of differences of pupillary diameter between control and post dacryocystorhinostomy (DCR) cases in pair 1 was  $\pm 1.4000$  with standard deviation (SD) of  $\pm 0.44120$  ( $P < 0.01$ ) which was statistically significant ( $P < 0.05$ ). The mean value of differences of pupillary diameter between control and post DCR cases in pair 2 was  $\pm 1.32000$  with SD of  $\pm 0.38809$  ( $P < 0.01$ ) which was statistically significant.

**Conclusion:** DCR surgery causes altered nasolacrimal anatomy leading to increased absorption of drugs.

**Key words:** Dacryocystorhinostomy, Phenylephrine 0.8%, Pupillary size, Tropicamide 4%

## INTRODUCTION

Autonomic nervous system controls the pupillary action.<sup>[1]</sup> The parasympathetic control is slightly more than sympathetic control.<sup>[2]</sup> Hence, parasympatholytics, as well as sympathomimetics, have been used to dilate the pupils for various procedures such as cataract surgery, funduscopy, retinal lasers, and refraction. Combination of both drugs offers greater pupillary dilatation than single drug uses.

Tropicamide is also a short-acting cycloplegic available in 0.5–1.0% solutions, acts as a competitive antagonist to acetylcholine.<sup>[3]</sup> It has the quickest (onset 20–40 min) briefest duration (3–6 h) action.<sup>[4]</sup> It is a competitive antagonist to acetylcholine and inhibits the cholinergic action on pupil and inhibits accommodation (cycloplegia). Phenylephrine is a sympathomimetics drug and it directly acts on the dilator pupillae muscle and has little effect on the ciliary muscle. Hence, it is not a cycloplegic.<sup>[3]</sup>

In patients who undergo dacryocystorhinostomy (DCR) surgery, the nasolacrimal passage becomes wider and shortened than the normal. Hence, the chance of absorption of topical drugs is higher than normal due to the exposed nasal mucosa in comparison to the normal side. Hence, ophthalmologists must have the knowledge about these facts. The purpose of our study was whether

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there were any significant changes of local effects of the post DCR patients.<sup>[5]</sup>

## MATERIALS AND METHODS

A prospective study was conducted on 150 eyes of 75 patients of unilateral nasolacrimal duct obstruction at a tertiary hospital over a period of 2 years (2014–2016). The patients were selected from the outpatient department irrespective of their sex and religion. The age group of the study was 15–50 years. The unaffected eye served as control.

On admission, the pupillary diameter was measured by slide caliper (vertical and horizontal) before and after application of tropicamide 0.8% and phenylephrine 5% drop, and this served as control for study purpose.

After 1½ month of DCR operation, the vertical and horizontal pupillary diameter was measured before and after instillation of tropicamide 0.8% and phenylephrine 5% drop.

The vertical papillary diameter in control and cases was grouped as pair 1, and the horizontal papillary diameter in control and cases was grouped as pair 2.

Before measurement of pupillary diameter in both the cases, patients were advised bed rest for half an hour for stabilization of the cardiovascular system.

### Inclusion Criteria

Patients who had unilateral nasolacrimal duct obstruction and “HARD STOP” on syringing with the presence of regurgitation through upper punctum.

### Exclusion Criteria

- Patients had a syringing finding of “SOFT STOP” which signified common canaliculi system block.
- Pregnant and lactating mothers.
- History of previous ocular surgery.
- History of hypertension, diabetes mellitus, dyslipidemia, and benign hypertrophy of prostate.
- Patients had a h/o glaucoma or other local ocular pathology.
- Ear, nose, and throat examination status to exclude any contraindication for DCR operation.

### Each Patient was Monitored Twice during the Course of the Study

- a) On admission, the pupillary diameter (vertical and horizontal) of the normal eye was measured by a slide caliper before and after application of tropicamide (0.8%) and phenylephrine (5%) eye drop and this served as the control eye for comparison.

- b) After 2 months of DCR operation, the operated eye was monitored with tropicamide (0.8%) and phenylephrine (5%) application which served as the study eye for comparison.

### The Following Operative Criteria were followed during DCR Operation

1. Double flap operation with anastomosis with 6–0 vicryl was done.
2. Bony ostium was at about 1 cm square area.

### During Application of Tropicamide and Phenylephrine the following Criteria were Monitored

1. Topical ophthalmic solution of tropicamide 0.8% and phenylephrine hydrochloride (5%) was used.
2. The pupillary diameter (vertical and horizontal) was measured before application of tropicamide 0.8% and phenylephrine hydrochloride (5%).
3. A single drop (approx. 30 µL size) was administered into the lower fornix in supine position at 10 min interval, 3 times, and the reading was taken 15 min after the last drop.
4. Patient was advised to keep his eyes closed for 2–3 min after instillation of drop.
5. Pupillary diameter measured again after 45 min of installation of the eye drop.

## RESULTS

Out of 75 patients, 42 were male and 33 were female patients [Table 1 and Figure 1]. There were 6 (8.0%) patients in 15–20 years, 21 (28.0%) in 21–30 years, 37 (50.0%) in 31–40 years, and 11 (14.0%) in 41–50 years of age group [Table 2 and Figure 2].

150 eyes of 75 patients having unilateral nasolacrimal duct obstruction of different age group 15–50 years irrespective of sex and religion were analyzed. The unaffected side

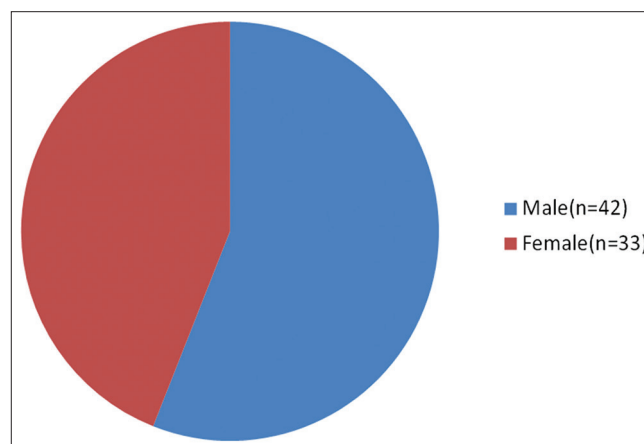


Figure 1: Sex distribution



served as “CONTROL GROUP” and affected side as “STUDY GROUP.”

All the patients were normotensive with normal intraocular pressure. None of them had a history of any ocular surgery, uveitis, posterior synechiae, and infectious disease.

**Table 1: Distribution of study subject by sex (n=75)**

Sex of the patients	Number of patients (%)
Male	42 (56.0)
Female	33 (44.0)

**Table 2: Distribution of study subject by age**

Age in years	Number of patients (%)
15–20	6 (8.00)
21–30	21 (28.00)
31–40	37 (50.00)
41–50	11 (14.00)
Total	75 (100)

**Table 3: The vertical and horizontal pupillary diameter in normal and post DCR cases**

Parameter	Mean	n	SD	Standard error mean
Pair 1				
Vertical pupillary diameter (control)	±3.4300	75	±0.48456	±0.06853
Vertical pupillary diameter post DCR pupillary vertical diameter (case)	±4.7500	75	±0.53690	±0.07593
Pair 2				
Horizontal pupillary diameter (control)	±3.4000	75	±0.52489	±0.07423
Horizontal pupillary diameter post DCR pupillary vertical diameter (control)	±4.8000	75	±0.44030	±0.06230

P<0.05. DCR: Dacryocystorhinostomy, SD: Standard deviation

Each patient was examined twice during the course of study.

- On admission, the control eye (normal eye) monitored before and after application of tropicamide (0.8%) and phenylephrine hydrochloride (5%) drop.
- 8 weeks after DCR operation the “Study Eye” (post DCR eye) was examined again after application of tropicamide (0.8%) and phenylephrine hydrochloride (5%) drop.

### Sex Wise Distribution

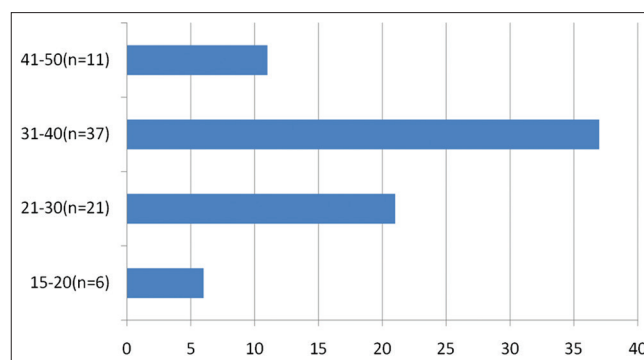
Out of 75 patients, 42 (56.0%) were male and 33 (44.0%) were female patients [Table 1 and Figure 1].

### Ocular Parameters

In control eyes (normal eyes), the pupillary diameter (vertical and horizontal) was measured before and 45 min after application of drop.

The mean value of vertical pupillary diameter in control and cases in pair 1 was  $\pm 3.4300$  and  $\pm 4.7500$ , respectively, with a standard deviation (SD) of  $\pm 0.48456$  and standard error  $\pm 0.06853$  ( $P < 0.05$ ) [Table 3].

The mean value of horizontal pupillary diameter in control and cases in pair 2 was  $\pm 3.4000$  and  $\pm 4.8000$ , respectively,



**Figure 2: Age distribution of the patient**

**Table 4: The paired difference between vertical and horizontal pupillary diameter of pupil in normal and post DCR case**

Parameter	Mean	SD	Standard error mean	95% confidence interval of the difference		t	Df	Significance (two-tailed)
				Upper	Lower			
Pair 1								
Difference between normal side pupillary vertical diameter and post DCR side pupillary vertical diameter	±1.4000	±0.44120	±0.0623	±1.29077	±1.59230	25.103	49	0.000
Pair 2								
Difference between normal side horizontal pupillary diameter and post DCR side pupillary horizontal diameter	±1.32000	±0.38809	±0.05488	±1.20971	±1.43029	24.051	49	0.000s

P<0.01. DCR: Dacryocystorhinostomy, SD: Standard deviation

with a SD of  $\pm 0.44030$  and standard error  $\pm 0.06230$  ( $P < 0.05$ ) [Table 3].

The mean value of differences of pupillary diameter between control and post DCR cases in pair 1 was  $\pm 1.4000$  with SD of  $\pm 0.44120$  ( $P < 0.01$ ) which was statistically significant [Table 4].

The mean value of differences of pupillary diameter between control and post DCR cases in pair 2 was  $\pm 1.32000$  with SD of  $\pm 0.38809$  ( $P < 0.01$ ) which was statistically significant [Table 4].

## DISCUSSION

In this study, ocular parameters were observed as below:

The vertical and horizontal pupillary diameter in the study eyes increased significantly in comparison to the normal eye 45 min after application of tropicamide 0.8% and phenylephrine 5% eye drops ( $P < 0.05$ ). This finding is corroborative with the earlier findings of Roy *et al.*<sup>[5]</sup> who reported a quicker highway for transport of ocular medications to the nasal mucus membrane, thereby causing greater systemic absorption.

It signifies that after removal of obstruction and shortening of the nasolacrimal passage, the local uptake of the eye drop is higher on the operated side in comparison to the normal side.

## CONCLUSION

It is reiterated that DCR surgery offers altered nasolacrimal anatomy and hence cause altered drug absorption in that anatomical location. Consequently, alteration in the pharmacodynamics of a drug and systemic adverse effects of drugs such as tropicamide 0.8% and phenylephrine 5% drop should be kept in consideration before its administration.

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# A Clinical Study on the Role of Color Doppler in Differentiating Pleural Thickening and Minimal Pleural Effusion in Adults

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## Abstract

**Background:** The wide application of color Doppler ultrasound (CDUS) in the diagnosis of thoracic lesions helps in detecting minimal pleural effusions. The discrimination of pleural thickening from minimal pleural effusion may be difficult as both lesions appear as anechoic on grayscale ultrasound. The CDUS fluid color sign helps in detecting minimal fluid in the pleural space.

**Aim of the Study:** The aim of the study was to evaluate the role of CDUS in differentiating minimal pleural effusion that could be aspirated from pleural thickening and to compare it with grayscale ultrasound.

**Materials and Methods:** A prospective analytical study conducted on 54 patients presenting with blunting of costophrenic angles on plain X-rays of the chest compatible with minimal pleural effusion. Initial grayscale ultrasound was done in all patients followed by CDUS examination. The fluid color sign was observed and later confirmed by thoracocentesis.

**Observations and Results:** The sensitivity of real-time grayscale ultrasound in detecting minimal pleural effusion and differentiating it from pleural thickening was 89.47% while, specificity was 41.10%, and accuracy was 69%. The specificity of CDUS in discriminating minimal pleural effusion from pleural thickening was nearing 98.75% while the sensitivity was 89.32% and accuracy was 96%.

**Conclusions:** Usage of CDUS increases the accuracy of real-time chest ultrasound to discriminate pleural thickening from minimal pleural effusion and hence color Doppler examination proved to be a useful diagnostic tool especially in minimal pleural effusion.

**Key words:** Color Doppler ultrasound, Effusion, Grayscale ultrasound, Pleura, Pleural thickening

## INTRODUCTION

Pleural effusion is defined as the accumulation of fluid in the pleural space due to not only pulmonary disease but also many other pleural and extrapulmonary diseases.<sup>[1,2]</sup> The ultrasound image of effusion is characterized by an echo-free space between visceral and parietal pleurae which may change in shape with respiration. With grayscale ultrasound examination of the chest, the sensitivity of identifying minimal fluid in the pleural space is high.

However, differentiating it from pleural thickening is difficult as both the lesions may appear anechoic in grayscale ultrasound. Free echoes do not guarantee the presence of fluid.<sup>[3,4]</sup> Whereas in color Doppler ultrasound (CDUS) as any movement of body fluid will be transferred as colored images; and hence, CDUS is being used widely in differentiating the pleural thickening and effusion. The fluid movement may occur during respiration or cardiac pulsations giving it a fluid color sign.<sup>[5]</sup> In pleural thickening, such colored signals are not elicited as it has no movable fluid in the pleural space.<sup>[6]</sup> The present study was conducted to evaluate the role of CDUS in the diagnosis and differentiation of minimal pleural effusion and pleural thickening and later on confirmed with thoracic aspiration.

### Institution of Study

The study was conducted at Kannur Medical College, Anjarakandy, Kannur.

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### Period of Study

The study period was from June 2013 to May/April 2016.

## MATERIALS AND METHODS

The present study was a prospective analytical study conducted over a cross-section of patients attending the Department of Medicine of a tertiary teaching Hospital in Northern Kerala. 54 patients with an X-ray chest finding of blunting of costophrenic angle (blunting of costophrenic [CP] angle) were included in the study. An Ethical Committee clearance was obtained, and an Ethical Committee cleared consent letter was used to collect the data.

### Inclusion Criteria

1. Patients aged between 20 and 60 years were included in the study.
2. Patients with X-ray chests showing blunting of CP angle were included.
3. Patients with both pulmonary and non-pulmonary diseases with effusion were included.
4. Patients with benign or malignant diseases of the lung were included.

### Exclusion Criteria

1. Patients below 20 and above 60 years were not included.

All the patients included in the study were elicited of thorough clinical history and clinical examination. X-ray chests posteroanterior view and lateral views were taken. Patients with X-rays showing blunting of CP angle in either anterior-posterior or lateral view were included. Grayscale ultrasound of the chest was performed in all the patients to detect the presence of pleural effusion. The acoustic window used was intercostals space with the patient either in sitting or supine position with the arm away from the chest. Presence of an anechoic space between the visceral pleura and the parietal pleura was taken as positive to pleural effusion. The presence of any of the signs such as split pleural signs, the internal echogenicity of the effusion, the change of shape during respiration, the presence of the mobile septa, and thickening of the pleura, and the presence of organized fluid in the pleural space was taken as pleural effusion. CDUS was done in all the patients and presence of colored signals was noted. As pleural thickening has no movable part, the colored signals will not be detected in cases of pleural thickening. After confirmation of pleural effusion by both grayscale and CDUS finally, thoracocentesis was done to aspirate pleural fluid. All the data were collected and analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 54 patients included in the present study, the age groups were 20–60 years with a mean age of  $36.38 \pm 4.62$  years. There were 31 male and 23 female patients with a male to female ratio of 1.34:1 [Table 1].

Among the 54 patients, all had blunting of CP angles findings in their X-ray chests (100%). Grayscale ultrasound showed anechoic areas, and other signs in 38/54 patients (70.37%) and 16 patients showed signs of pleural thickening (29.62%). Among the 38 reports of positive for anechoic areas positive pleural tap was found in 34 (89.47%) of the patients, the remaining 4 (10.52%) were negative for pleural fluid [Table 2]. Pleural thickening was reported in 16/54 patients (29.62%); pleural tap was positive in 2/16 patients (12.5%), and the remaining 14 patients it was negative (87.5%), [Table 2]. The sensitivity of grayscale ultrasound in the diagnosis of pleural effusion was 89.47%, and the specificity was 70.37%.

Similarly following CDUS 29/54 showed colored signal indicating pleural effusion but 27/29 only had positive pleural tap for fluid (93.10%). The pleural tap was negative in 2/29 patients (6.89%). In 25/54 patients the report was given as pleural thickening; among these patients, the tap was negative in 22/25 (88%) and positive in 03/25 (12%) patients [Table 3]. The sensitivity of CDUS in the diagnosis of pleural effusion was 93.10%, and the specificity was 53.70%. Similarly, the sensitivity of CDUS in diagnosing pleural thickening was 88%, and the specificity was 46.29%.

## DISCUSSION

Pleural effusion is a common clinical entity treated by physicians all over the world. The effusion results either

**Table 1: The age and gender incidence in the study (n=54)**

Observation (years)	Male-31	Female-23
20–30	08	04
30–40	07	07
40–50	09	05
50–60	07	07

**Table 2: The findings of grayscale ultrasound with positive and negative pleural tap (n=54)**

Observation	Grayscale ultrasound (%)
CP angle blunting	-
Anechoic areas	38/54–70.37
Pleural tap positive	34/38–89.47
Pleural tap negative	04/38–10.52
Pleural thickening	16/54–29.62
Pleural tap positive	02–12.5
Pleural tap negative	14–87.5

CP: Costophrenic

**Table 3: The findings of CDUS with positive and negative pleural tap (n=54)**

Observation	CDUS (%)
CP angle blunting	-
Colored signal	29/54–53.70
Pleural tap positive	27/29–93.10
Pleural tap negative	02/29–06.89
Pleural thickening	25/54–46.29
Pleural tap positive	03/25–12
Pleural tap negative	22/25–88

CDUS: Color Doppler ultrasound, CP: Costophrenic

due to disease in the lung parenchyma, disease proper in the pleural layers and non-pulmonary causes such as malignant diseases of the ovaries, liver, and distant metastases. Imaging studies are the cornerstones in their appropriate diagnosis and treatment. X-ray chest is the initial diagnostic method which is cost-effective but not sensitive in detecting the pleural effusions. At least 150 ml must have accumulated in the pleural space for the radiological evidence to appear on an upright X-ray.<sup>[7]</sup> Sometimes pleural lesions as pleural thickening and fibrosis may mimic minimal pleural effusion in plain radiograph.<sup>[8]</sup> Grayscale ultrasonography of the chest has been documented in the world literature as an important primary diagnostic tool for pleural effusion to confirm the presence of effusion in a patient with abnormal chest radiographs. Grayscale ultrasound will detect as little as 5–50 ml of pleural fluid and with 100% sensitivity in effusions  $\geq 100$  ml.<sup>[9]</sup> Another added advantage being the machine a portable one, low cost without radiation exposure with an ability to perform both dynamic and real-time procedures.<sup>[10]</sup> In the present study, the grayscale ultrasound showed sensitivity in the diagnosis of pleural effusion of 89.47% and the specificity being 70.37%. In pleural effusion patients, the grayscale US gives anechoic areas within the pleural space which change its shape on respiratory movements. The effusion may also present with movable septae confirming the presence of fluid. When the fluid collection is small and associated with septae, these features are absent and aspiration may be difficult.<sup>[11,12]</sup> Benign lesions of the visceral or parietal pleura and pleural thickening on grayscale appear as focal echogenic lesions mimicking fluid collection hence it is mandatory that these lesions are identified before pleural tap is attempted.<sup>[13]</sup> CDUS is useful in such situations where there is difficulty in identifying fluid with the help of grayscale ultrasound.<sup>[14]</sup> In the present study, CDUS was used in 54 patients to differentiate between pleural thickening and effusion and was observed that the sensitivity of CDUS in the diagnosis of pleural effusion was 93.10% and the specificity was

53.70%. Similarly, the sensitivity of CDUS in diagnosing pleural thickening was 88%, and the specificity was 46.29%. Tsai and Yang *et al.*<sup>[15]</sup> from their study confirmed that the presence of an echo-free space between the visceral and parietal pleura that changes shape with respiration or contains movable strands or echo densities on grayscale US, or displays a fluid color sign on color Doppler US, indicates the presence of fluid accumulation.

## CONCLUSION

Usage of CDUS increases the accuracy of real-time chest ultrasound to discriminate pleural thickening from minimal pleural effusion, and hence, color Doppler examination proved to be a useful diagnostic tool especially in minimal pleural effusion.

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# Variations in the Physico-chemical Factors and Zooplankton Diversity during Monsoon and Post-monsoon Period of a Bavori in JDB College Campus Kota, Rajasthan, India

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## Abstract

**Introduction:** The zooplanktons play an important role in an aquatic ecosystem, and they are sensitive bioindicators too. Any change in water quality due to the addition of pollutants affects the diversity and abundance of the organisms residing in it.

**Aim:** The present investigation was carried out to study an aquatic ecosystem in its simpler form. Till now most of the study of zooplankton was done in polluted aquatic systems. Therefore, we focused our attention on aquatic ecosystem which is free of any direct pollution source.

**Materials and Methods:** The present study was conducted during the monsoon and the post-monsoon periods from July 2010 to December 2010 of a Bavori situated in the JDB college campus of Kota city. The physicochemical and biotic factors of the Bavori were observed. Among the abiotic factors pH, water temperature, dissolved oxygen, free CO<sub>2</sub>, alkalinity, salinity and total hardness were estimated.

**Results:** The water temperature ranged from 20°C to 31°C. The pH always indicated alkaline values (8.3–8.9). The dissolved oxygen varies from 3.5 to 8.3; while free CO<sub>2</sub> ranged from 2.0 to 8.9 mg/L. The alkalinity showed variation from 150 to 170 mg/L. The hardness observed from 38.0 to 62.0 mg/L, it is high in late monsoon. The zooplankton community protozoans, rotifers, annelids, and arthropods predominantly showed their existence 8 orders and 11 species of protozoans, 2 orders and 11 species of rotifers, one order with only one species of annelids, and 11 orders with 21 species of arthropods were seen.

**Conclusion:** During the monsoon season abundance of the protozoans, rotifers, arthropods and annelids were seen. But with the onset of post-monsoon their quality and quantity decreased significantly. A total 22 orders and 43 species were observed in the present study. This showed a hotspot of species diversity which needs measures of its conservation to protect them.

**Key words:** Freshwater, Physico-chemical variations, Zooplankton

## INTRODUCTION

The freshwater deposit (Bavori) was selected for the present investigation to study an aquatic ecosystem in its simpler form. Till now most of the study of zooplankton

was done in polluted aquatic systems.<sup>[1,2]</sup> Therefore, we focused our attention on the aquatic ecosystem which is free of any direct pollution source. The Bavori is free of any direct anthropogenic interference and is the main source of water availability to the animals living around it, e.g. various colonies of *Rhesus macaca*, *Pavo cristatus*, *Corvus splendens*, and many other local and migratory birds among terrestrial vertebrates. This vertebrate's dependency can be seen directly, but for invertebrates, the dependency always remains hidden. The purpose of the present study is to prove the importance of this Bavori and others such sites, for various biological reasons and to conserve the delicate interwoven food-webs found in nature. The various physico-

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chemical factors were also observed to study the abiotic factors prevailing around such important habitat areas.

Biodiversity is the diversity of biotic communities which encompasses different genera, species, communities, and ecosystems and their relative abundance. A good aquatic ecosystem is reflected by the rich diversity of organisms found in it and any change in water quality due to the addition of pollutants affects the diversity and abundance of the organisms residing in it. The zooplankton play an important role in an aquatic ecosystem (Sharma, 1998) and they are sensitive bioindicators too. Due to their small size, delicacy and shorter lifespan, they respond quickly to the changing environmental conditions. The Rajasthan is a part of the Thar Desert, but the Kota city constitutes the mesic zone of Rajasthan, due to the river Chambal passing through it.

### Study Area

The Bavori is situated in the south-west side of the college campus in Kota city. The Kota city lies between 24° 25' and 25° 51' North latitudes and 75° 31' and 77° 26' East longitudes with a total area of 5767.97 sq. km. "Kota city" is located at the extreme south of it at 25° 11' North latitude and 75° 51' East longitude occupying a total area of 238.69 sq. km, with an average height of 253.30 m from the sea level. The district Kota touch the boundaries of Sawai Madhopur, Bundi and Tonk district in Northwest, Chittorgarh in West, Jhalawar in South and Baran in East.

Kota is a prime industrial town of Rajasthan with the historical importance of its own. In last decade it has emerged as "Educational city" of India, mainly due to its excellence in coaching for entrance examinations of national and state level technological institutes for engineering and medical courses. Kota is also well known for its "Kota Sarees and Kota Stone" it is well connected with all major cities of India by the broad gauge railway system. National Highway 12 Jaipur to Jabalpur and 76 Shivpuri to Pindwara passes through the city.

Geomorphologically Kota city is situating in the Northern part of the Malwa Plateau. The only perennial river "Chambal" originating from the hills of western Madhya Pradesh passes through the district.

## MATERIALS AND METHODS

Different physico-chemical parameters were analyzed from July 2010 to December 2010. Sampling was done after every 15 days, between 8 am and 11 am to work out the parameters such as water temperature, dissolved oxygen, free CO<sub>2</sub>, alkalinity, salinity, and total hardness. The water temperature was noted using a mercury thermometer, pH of the water was determined using portable electronic

digital pH meter. Dissolved oxygen, free CO<sub>2</sub>, alkalinity, salinity, and total hardness were evaluated as described in standard methods for the estimation, by American Public Health Association (APHA) 1995.<sup>[3]</sup>

For the study of zooplankton samples were collected twice a month. They were studied under the microscope in free-floating state in cavity slides, and some zooplankton were studied using coverslips on it. Their study was conducted to identify them by their feeding, breeding, and locomotory habits. For qualitative analyses, the keys given in Edmondson (1959), Needham and Needham,<sup>[4]</sup> Pennak,<sup>[5]</sup> Tonapi,<sup>[6]</sup> Battish<sup>[7]</sup>, and APHA<sup>[3]</sup> were utilized.

## RESULTS

The zooplankton species recorded from the surface-water of the Bavori are enlisted below. The results indicated the presence of *Paramecium caudatum*, *Euglena*, *Chrysamoeba*, *Chlamydomonas*, colonies of *Volvox*, *Arcella*, *Vorticella*, *Stentor*, *Diatoms*, *Philodina*, water spiders, aquatic beetles, *Daphnia*, *Anopheles*, and *Culex* larvae, many types of insects and crustaceans larvae in the month of July. In the first 2 weeks of August, the presence of colorless flagellates, *Paramecium*, *Philodina*, *Brachionus*, *Notonecta*, *Cypris*, *Centro cypris*, *Heterocypris*, aquatic beetles, *Dytiscus*, *Tubifex*, larva of dragon fly, and *Anopheles* larvae were seen. While in the late the August, the richness of *Centro cypris*, *Notonecta*, and *Colurella obtusa* was seen. During the month of September *Rotifers*, *Shredder*, *Centro cypris* and in the 1<sup>st</sup> week of October presence of *Centro cypris*, *Daphnia*, many types of insects larvae, *Brachionus*, *Asplanchna*, *Priodonta* and various types of *Protozoans* were seen. In November, the presence of *Decapods* and *Brachionus* were observe while in the month of December mostly *Brachionus* and small number of crustaceans were observed.

Among the abiotic factors [Table 1] temperature, dissolved oxygen, free CO<sub>2</sub>, alkalinity, salinity, and total hardness of water were evaluated. The temperature showed the variation from 18°C to 31°C. In the Bavori, the pH always remained alkaline, i.e., it showed variation in between 8.3 and 8.9. The dissolved oxygen contents remained in between 3.5 and 8.3 mg/L, while free CO<sub>2</sub> ranged from 2.0 to 8.9 mg/L. Alkalinity showed a variation of 150–172 mg/L. The salinity ranged in between 7.2 and 29.1 mg/L. The hardness varied in between 38 and 62 mg/L.

### List of Zooplanktons Found in Bavori of JDB College Campus, Kota

#### 1. Phylum – Protozoa

Subphylum – Sarcomastigophora



Supper class – Flagellata  
 Class - Phytomastigophorea  
 Order – Chrysomonadida  
 Organism – *Chrysamoeba*

Order – Euglenida  
 Organism – *Euglena*, *Trachelomonas hispida* (Shell)

Order – *Volvacida*  
 Organism – *Chlamydomonas*, *Volvax*

Order – Chrysomonadida  
 Organism – *Chryseomonas socialism*

Supperclass – Sarcodina (Rhizopoda)  
 Class – Rhizopoda  
 Order – Arcellinida (Testacida)  
 Organism – *Arcella discoides*, *A. vulgaris*

Subphylum – Ciliophora  
 Class – Ciliata  
 Subclass – Holotricha  
 Order – Hymenostomatida  
 Organism – *Paramecium* [Figure 1]

Subclass – Peritricha  
 Order – Peritrichida  
 Organism – *Vorticella*

Subclass – Spirotrichia  
 Order – Heterotrichida  
 Organism – *Stentor*

2. *Phylum – Rotifera*  
 Class – Monogononta  
 Order – Ploima  
 Organism – *Asplanchna priodonta* [Figure 2], *Brachionus angularis*, *B. bidentus*, *B. calceifloris*, *B. caudatus*, *B. forphileula* [Figure 3], *B. pala* [Figure 4], *B. precatilis* [Figure 5], *B. quadridentus* [Figure 6], *Keratella* [Figure 7]

Class – Bdelloidea  
 Organism – *Philodina roseola*

3. *Phylum – Annelida*  
 Class – Oligochaeta  
 Order – *Plesio pora plesio the cta*  
 Organism – *Tubifex* [Figure 8]



Figure 1: *Paramecium*



Figure 2: *Asplanchna*

**Table 1: Physico-chemical characteristics of the Bavori in monsoon and post-monsoon period**

Parameters	Monsoon period			Post-monsoon period		
	Peak	Mid	Late	October	November	December
	July	August	September			
Water temp.	28°C	31°C	29°C	29°C	25°C	18°C
pH	8.5	8.3	8.4	8.5	8.7	8.9
Dissolved oxygen	8.0	8.3	7.8	4.8	3.5	6.5
Free CO <sub>2</sub>	2.0	5.5	8.9	8.6	6.3	3.5
Alkalinity	170	169	172	150	125	155
Salinity	7.2	21.5	29.1	16.7	16.2	17.3
Hardness	38	40.8	44	48.6	56	62

All values in mg/L. except temperature and pH

4. *Phylum – Arthropoda*  
Subphylum – Chelicerata  
Class – Arachnida  
Order – Araneae  
Organism – Water Spiders

Subphylum – Mandibulata  
Class – Crustacea  
Organism – *Nauplius* larva [Figure 9]



Figure 3: *Brachionus forficula*



Figure 6: *Brachionus quadridentus*

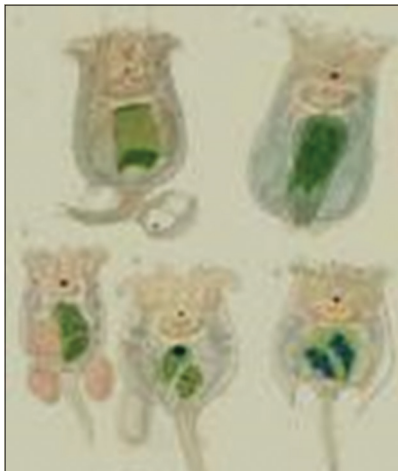


Figure 4: *Brachionus pala*



Figure 7: *Keratella*

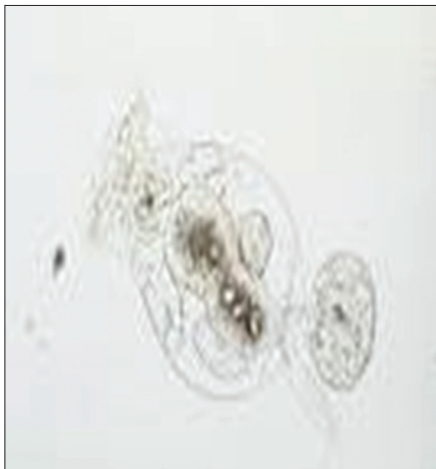


Figure 5: *Brachionus plicatilis*



Figure 8: *Tubifex*

Subclass – Branchiopoda

Order – Anostraca

Organism – *Notonecta*, *Belostoma* [Figure 10]

Order – Diplostraca or Cladocera

Organism – *Daphnia* [Figure 11], *Chydorus gibbus* [Figure 12]

Subclass – Ostracoda

Order – Podocopa

Organism – *Cypris* sp., *Heterocypris* sp., [Figure 13], *Stenocypris* sp.

Subclass – Copepoda

Order – Cyclopoida

Organism – *Cyclops*

Subclass – Malacostraca

Order – Mysidacea

Organism – *Mysis* sp.

Class – Insecta

Subclass – pterygota (Metabola)

Order – Ephemeroptera

Organism – Ephemer (Mayfly) Nymph [Figure 14]

Order – Odonata

Organism – Dragon fly Nymph

Order – Hemiptera

Organism – *Notonecta*, *Bellohtoma*, *Gerris* sp., *Corixa*, *Laccotrephes* [Figure 15]

Order – Coleoptera

Organism – Water beetles, *Dytiscus*

Order – Diptera

Organism- *Culex* larva, *Chilomonas*

## DISCUSSION

The zooplankton are the microscopic organisms and include mainly Protozoans, Rotifers, Annelids, and Arthropods. They occupy an intermediate position in the food-web. Zooplanktons mediate the transfer of



Figure 9: *Nauplius*



Figure 11: *Daphnia*



Figure 10: *Belostoma*



Figure 12: *Chydorus gibbus*



Figure 13: *Heterocypris*Figure 15: *Laccotrephes*Figure 14: *Mayfly nymph*

energy from lower to higher trophic level.<sup>[8]</sup> According to Reid (1961), the development and maintenance of a population of organisms depends on harmonious balanced between environmental conditions and variations in these conditions. The parameter of temperature is of utmost importance, for its effects on metabolism, species composition and reproduction of the aquatic organism. It acts as a catalyst, an activator, a stimulator, a controller and a regulator. It plays an influential role in the aquatic system. The peak monsoon showed 28°C while midmonsoon showed 31°C temperature. This was due to cloudy weather conditions. The temperature declined in post-monsoon to 18°C as winter approached. In this Bavori pH was always alkaline, ranged from 8.3 to 8.9, indicating the preferences of alkaline water. Bayars (1960) and Fogg *et al.*<sup>[9]</sup> too reported that zooplankton preferred the alkaline nature of water. Lesser values of the dissolved CO<sub>2</sub> i.e., 2.0 mg/L may be due to rapidly increasing phytoplankton population and their utilization for photosynthesis. While the midmonsoon showed the higher value of the CO<sub>2</sub> due to rapid growth and increasing

activities of the zooplankton, their CO<sub>2</sub> expiration increased exponentially. Lesser values of the salinity in the peak-monsoon might be due to higher dilution, which latter on increases in the mid- and the post-monsoon due to the mixing of water with sediments. While in the post-monsoon period showed a decreasing value due to gradual sedimentation. Lesser value of the hardness in the peak monsoon showed dilution of the water which due to evaporation increases gradually. Due to this reason, the number of delicate species too gradually decreases in post-monsoon period. Present results indicated the presence of *Insecta*, *Rotifera*, and *Crustacean* species in the post-monsoon months. Kurasawa (1975) reported dominance of *Copepoda* in the oligotrophic lakes and *Cladocera* or *Rotifera* in the eutrophic lakes as confirmed by our result too. In our result, *Cladocera*, *Podocoda*, *Cyclopoida*, *Odonada*, *Ploima*, and *Bdelloidea* showed the presence with increasing eutrophication in Bavori confirmed the above findings. *Brachionus* was also reported to be the dominant form in Bikaner<sup>[10]</sup> and in Ramgarh Lake.<sup>[11,12]</sup>

This Bavori was found rich in diversity with respect to the zooplankton. However, a clear seasonal fluctuation was observed in the diversity of the zooplankton in the months of monsoon and post-monsoon. In the monsoon abundance of *Protozoans*, *Rotifers*, *Arthropods*, and some forms of *Annelids* were observed. While in the desiccating seasonal water bodies, the decreasing diversity of the zooplankton were observed in the post-monsoon months.

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# A Prospective Observational Study of Anesthetic Complications in Children Undergoing Primary Lip and Palate Repairs

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## Abstract

**Background:** Children coming for cleft lip (CL) and palate repair are at increased risk of pre-, intra-, and post-operative respiratory complications. These anatomical abnormalities associated with CL and palate and increased the risk of airway complications associated with them are studied.

**Aim:** The aim of the study was to determine the incidence of airway and respiratory complications during CL and palate repair and identify risk factors.

**Materials and Methods:** After the Institutional Ethics Committee approval and written informed consent, 100 children of ASA Grade I presented with CL /palate/both were enrolled for this prospective randomized observational study, standard induction was employed and intubated with a RAE tube, anesthesia maintained, and appropriate analgesia given. At the end of surgery, children were extubated. All intraoperative or immediate post-operative airway complications were documented.

**Results:** The most common complication was desaturation (5%) followed by tube disconnection (4%). The incidence of post-operative complications is 7%, airway edema (2%), post-operative nausea and vomiting (5%) occurred, 14.89% of patients who had cleft palate (CP) repair developed complications, 12.25% who had CL repair developed complications, and 50% of patients who had combined lip and palate (CLP) repair developed complications. Complications occurred in 38.4% of patients having CP repair, 15.8% having CL repair, and 50% having CLP repair.

**Conclusion:** Cleft repair had a high incidence of airway/respiratory complications, and more complications occurred with CP surgery. There is a need to ensure adequately skilled personnel and appropriate monitoring to minimize morbidity.

**Key words:** Airway complications, Anesthesia, Cleft lip, Cleft palate

## INTRODUCTION

Children, especially infants, have a higher incidence of anesthetic-related complications. Due to their peculiar pediatric airway, they are prone to difficult airway management and laryngoscopy as well as other airway complications. Bordet<sup>[1]</sup> demonstrated that airway

complications occurred in 7.87% of children under anesthesia and that the incidence varied with the type of airway device used with laryngeal mask airway having the highest incidence of 10.2%, tracheal tube 7.4%, and facemask 4.7%. Patients for cleft repair are at increased risk of intraoperative airway and respiratory complications. The anatomical defects increase the risk of difficult laryngoscopy and intubation and problems with tracheal tubes occur more frequently. The documented incidence of difficult airway in cleft surgery ranges from 4.7% to 8.4%.<sup>[2,3]</sup> Various researchers have enumerated factors associated with an increased risk of airway complications in these patients. They include anatomical difficulty in placement of laryngoscope blade,<sup>[4]</sup> the presence of associated facial deformities, for example, micrognathia<sup>[5]</sup>

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and the degree of deformity with a higher risk occurring in combined bilateral clefts. The difficulty in laryngoscopy and intubation seen in cleft palate (CP) patients is related to age, being higher in infants. The risk of perioperative respiratory adverse effects is less if tracheal intubation is facilitated by muscle relaxants<sup>[6,7]</sup> and accidental extubation when positioning the head for surgery is minimized if the tube is placed 1.5 cm above the carina.<sup>[8]</sup> Recurrent infections of the nasal cavity and respiratory tract due to constant irritation and aspiration increase airway reactivity and may result in laryngeal and bronchospasm.<sup>[9]</sup> Takemura *et al.*<sup>[10]</sup> defined perioperative respiratory symptoms (PRC) as the occurrence of laryngospasm or bronchospasm during induction; increased airway secretions and desaturation (<95%) during maintenance and respiratory symptoms observed immediately after extubation. They observed that children with borderline common cold symptoms had a higher incidence of perioperative respiratory complications (23%) during cleft surgeries compared to healthy children with the incidence of 4%. The purpose of this prospective study was to determine the incidence of intraoperative airway and respiratory-related complications during cleft lip (CL) and palate repair and to identify risk factor for their occurrence.

## METHODS AND MATERIALS

Hundred patients undergoing CL and/or palate repair were prospectively studied after the Institutional Ethical Committee approval and informed parental consent were obtained. This study was performed according to the declaration. 100 cases of patients undergoing CL and palate repair were prospectively studied during a period of 1½ extending from June 2012 to February 2014. The present series constituted hospital admissions in plastic surgery ward, Government General Hospital. The patients were seen in the preanesthetic clinic by the oral and maxillofacial surgeons and anesthesiologists. Those suitable for surgery were admitted into hospital 2 days before surgery, and all eligible children were included in the study. Patients with respiratory tract infection were treated with appropriate antibiotics, and surgery deferred for 2 weeks in upper respiratory tract infection or 4 weeks in lower respiratory tract. Routine pre-operative fasting guidelines were instituted. No patient received sedative premedication. Standard inhalational halothane induction or intravenous induction using thiopentone or propofol was employed. The trachea was intubated with a RAE tube or armored endotracheal tube for surgeries under deep inhalational anesthesia or muscle relaxants. Standard intraoperative monitoring was employed. Surgical site was infiltrated with adrenaline 3–5 mcg/kg of 1:100,000 solution before the incision was made. Maintenance of anesthesia was

with sevoflurane/isoflurane, and a muscle relaxant and ventilation were controlled [Figures 1 and 2]. Appropriate analgesia with IV analgesics or blocks was ensured. At the end of surgery, children were extubated when fully awake with protective airway reflexes. All intraoperative or immediate post-operative airway complications were documented. For the purpose of the study, the following definitions were used – difficult intubation is with more or equal to three attempts at intubation, desaturation is a fall in oxygen saturation to <90%, bronchospasm is wheezing, with prolonged expiratory phase and increase in slope of plateau on capnography tracing, laryngospasm is desaturation of SpO<sub>2</sub> <90%, with partial or complete airway obstruction unrelieved by routine airway maneuvers. Data were analyzed using the SPSS for Windows (version 10.1; SPSS Inc, Chicago, IL) statistical software package. Numerical data were expressed as mean ± standard deviation while categorical data were expressed as frequencies. Tests of significance (*t*-test, Chi-square or Fisher's exact test) were used as appropriate. A *P* < 0.05 was considered statistically significant.

## RESULTS

The mean age of patients studied was 24.62 months (range 3–180 months) with a median of 20 months, of which mean 15.22 in CL, 35.23 in CP, and 35.25 in combined lip and palate (CLP) [Table 1] which is insignificant. Forty-nine patients (49%) had primary CL repair, 47 (47%) had primary CP repair, and 4 (4%) had CLP repair. Table 2 describes incidence of complications occurred (incidence - 21% of 100 procedures). Some patients developed more than one complication. The most common complication was desaturation (5%), followed by tube disconnection (4%), difficult intubation (4%), tube compression (2%), and laryngeal spasm (1%). The incidence of post-operative complications is 7%, airway edema (2%), and post-operative nausea and vomiting (5%). Table 3 displays the incidence of complications in relation to the surgical procedure. 14.89% of patients who had CP repair developed complications, 12.25% who had CL repair developed complications, and 50% of patients who had CLP repair developed complications. The occurrence of endotracheal tube-related laryngospasm and desaturation occurred in patients who had inhalational induction of anesthesia. Desaturation mostly occurred at intubation. All episodes of laryngeal spasms occurred at induction.

## DISCUSSION

This study has demonstrated an incidence (21%) of airway and respiratory complications in cleft surgery. A study from Tokyo observed a 4% incidence of respiratory complications



**Table 1: Demographic data in age and weight**

Surgical procedure	Age in months (mean±SD)	Weight in kg (mean±SD)
CL	15.22	8.6
CP	35.23	13.45
CLP	31.25	13

CL: Cleft lip, CP: Cleft palate, CLP: Combined lip and palate, SD: Standard deviation

**Table 2: Incidence of complications**

Complications developed	Number of complication(%)
Desaturation	5
Laryngospasm	1
Difficult intubation	2
Tube compression	2
Tube disconnection	4
Airway edema	2
PONV	5

PONV: Post-operative nausea and vomiting

**Table 3: Incidence of complications in relation to surgical procedures**

Surgical procedures	Total number of cases	Number of cases developed complications
CL	49	6
CP	47	7
CLP	4	2

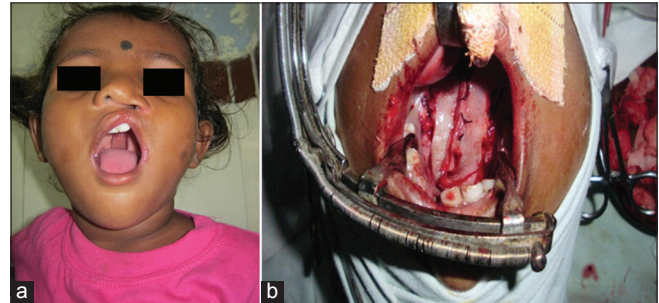
CL: Cleft lip, CP: Cleft palate, CLP: Combined lip and palate

in cleft surgeries in infants <6 months, but they did not take into account tube-related factors and intubation difficulties. Fillies<sup>[9]</sup> demonstrated an 8.6% incidence of respiratory complications in their series of 174 infants. However, they administered atropine pre-induction which could have accounted for their reduced incidence. In addition, oxygen saturation <85% was taken as the definition of desaturation compared to <90% used in the present study.

CL repair is recommended at the age of 3 months to improve cosmetic appearance and parent-child bonding, while CP repair is performed for 9 months to allow for facial growth and speech development. Stephen performed CL repair in neonates and reported no evidence to prove that it was unsafe.<sup>[7]</sup> A large proportion of patients were older than 1 year because they are kept in hiding due to associated stigma as well as financial constraints.

Some of the African authors have documented this observation. The incidence of critical events in general pediatric anesthesia is documented to be 8.6% in infants which improves to 2.1% in older patients with a statistically significant difference in children <10 kg.<sup>[11]</sup>

Murat *et al.*<sup>[12]</sup> reiterated that intraoperative adverse events were more likely in infants <12 months.

**Figure 1: Photographs of cleft lip (a) pre-operative cleft lip and (b) intraoperative cleft lip****Figure 2: Photographs of cleft palate (a) pre-operative palate and (b) intraoperative palate**

Airway and respiratory complications occurring in cleft surgery repair are often due to intubation, tube-related problems, laryngeal and bronchospasm, desaturation, and aspiration. The peculiarity of the infant airway commonly results in difficult airway management and intubation which is aggravated by the existence of CL or palate. The cleft alveolus, protruding maxilla, and high vaulted arch cause difficult placement of the laryngoscope blade because of loss of support which results in obstruction of the view needed for normal intubation.

In this study, the incidence of airway complications was more in patients having CP repair (14.89%) compared to CL repair (12.25%).

Gunawardana<sup>[8]</sup> reported the occurrence of difficult laryngoscopic view of Cormack-Lehane Grade III and IV, which was found to be 3.0% in patients with unilateral CL, 45.8% in patients with bilateral cleft, and 34.8% in patients with retrognathia.

In the present study, 2% incidence of difficult intubation was recorded. Difficult intubation occurred in a 9-month-old child scheduled for CL surgery during attempts at intubation under deep inhalational anesthesia.

The child was subsequently intubated under muscle relaxation by a consultant grade anesthesiologist. A second case of difficult intubation occurred in a 2-year-old child for CLP repair, and these two cases were probably due to difficulty in inserting the laryngoscope blade or by the presence of micrognathia.

The blade commonly falls into a left-sided cleft when the tongue is being swept to the left side during laryngoscopy and alters the line of vision posing intubation difficulties.<sup>[13]</sup>

The risk of perioperative respiratory adverse events is less if tracheal intubation is facilitated by muscle relaxation.<sup>[14,15]</sup> In this study, there is the usage of muscle relaxants for intubation in majority of our patients, which may have accounted for our lower incidence. Muscle relaxants cause relaxation of the head and neck muscles and assist in obtaining a better laryngoscopic view.

Positioning the patient in the optimal sniffing position by the use of a shoulder roll, routine use of optimal external laryngeal maneuver, intubating stylet, and having a senior anesthesiologist intubate the patient are quoted as being contributory toward an easier intubation.<sup>[16]</sup>

Tracheal tube problems occurred in five patients (6%) in our study, of which there was tube disconnection in four (4%) and tube compression in two (2), disconnections occurred mostly in patients having CP repair.

The introduction of a mouth gag necessary for palatal repair can compress or move the tube. This is easily detected clinically by tight bag and difficulty in ventilation followed by desaturation, and this can also be detected by airway pressure monitoring and capnography tracing which emphasizes the importance of adequate monitoring for early detection. The positioning of the patient for surgery also contributes to tube movement.

Neck extension causes backward movement of the tube away from the carina while flexion can result in endobronchial placement. Poor nutrition and development which characterize CLP patients may influence the calculation for correct placement of the tracheal tube.

Kohjitani *et al.*<sup>[17]</sup> demonstrated that, if the tracheal tube is placed 1.5 cm above the carina in the neutral head position, it minimizes the chance of accidental extubation when the head is extended.

In this study, there were no accidental extubations as the tube is firmly secured to prevent any movement and tube position is noted and checked after positioning.

The incidence of laryngospasm in our study was 1%.

In Bordet's study, the incidence of bronchospasm and laryngeal spasm in intubated patients was 41%. Infants and small children with CP frequently have running nose, coryza, and upper respiratory tract infections

(RTIs) which may predispose to perioperative respiratory complications.<sup>[3]</sup> In such cases, elective surgery should be deferred for 2–3 weeks so that airway reactivity returns to normal.<sup>[18]</sup>

Olsson and Hallen<sup>[19]</sup> found that laryngospasm was more common in infants than in older children and data varied among the anesthesia providers as has in those with pre-operative respiratory infections sample size. All episodes of airway spasm occurred in patients who had an inhalational induction.

This may reflect the younger age group of the children who had inhalational induction compared to those who had an intravenous induction.

The administration of dry gases causes irritation to the airway which predisposes to spasm, especially in patients with already hyperactive airway from recurrent infections. The presence of symptoms of common cold preoperatively significantly increases the risk of PRC.

Mamie *et al.*<sup>[15]</sup> demonstrated a positive association between airway complications and age <6 years, and Murat *et al.*<sup>[12]</sup> observed that respiratory complications were greater in infants compared to children aged 1–7 years.

Laryngospasm occurred in one case which was managed successfully by early identification and active treatment. These patients had pre-operative upper respiratory tract infection. Infants and small children with CP frequently have common cold and upper respiratory tract infection which may predispose to perioperative respiratory complications.<sup>[3]</sup>

Fillies *et al.*,<sup>[9]</sup> on the other hand, demonstrated a direct correlation between weight and complications with children weighing 4–6 kg having the highest complication rate. We investigated that weight-related complications were similar between different groups and did not vary significantly. Low birth weight was recorded in eight (8%) cases, most of which were CL repair cases. Two of these cases were complicated, one of which had desaturation due to undisclosed and untreated recurrent RTI, and another was tube disconnection.

Our study has emphasized the importance of having skilled personnel, appropriate monitoring equipment, and airway devices available during cleft surgeries to minimize morbidity. The use of muscle relaxation for intubation should be advocated after it has been confirmed that the patient can be manually ventilated by facemask as this would provide adequate intubating conditions and prevent laryngeal spasm.

An oral RAE tube during CP repair would avoid tube compression due to the introduction of a mouth gag.

## SUMMARY AND CONCLUSION

Anatomical abnormalities associated with CL and palate increase the risk of airway complications. The aim of this study was to determine the incidence of intraoperative airway and respiratory complications during CL and palate repair and identify the risk factors. In this observational study, in which hundred patients undergoing CL or/and palate repair (CL, CP, CLP) were prospectively studied in a tertiary care teaching institution, in Guntur, the incidence of complications in CP surgeries was 14.87%, CL surgeries was 12.25%, and combined CL and palate surgeries was 50%. Airway complications are relatively common during cleft surgeries. The incidence of airway complication in the present study was 21% and occurred most commonly in patients undergoing primary CP repair. Laryngoscopy and intubation are associated with a number of complications, may become extremely difficult at times, and predispose to perioperative adverse events which can be avoided by strict vigilance, presence of experienced personnel, and mutual understanding between the surgeon and the anesthesiologist.

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# A Clinical Study on Pulmonary Function Tests in Adult Patients with Type-2 Diabetes Mellitus

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## Abstract

**Background:** The effect of diabetes mellitus (DM) on pulmonary functions and the prevalence of pulmonary complications are poorly characterized. Few authors report normal pulmonary functions and even concluded that spirometry is not at all necessary in diabetic patients. Some studies have shown a reduction in lung capacity in patients of DM and reported a varied impact depending on the duration and glycemic control of DM.

**Aim of the Study:** The aim of this study is to evaluate pulmonary functions of patients with DM Type-2 in the northern part of Kerala.

**Materials and Methods:** A 104 subjects were divided into two groups, Group "A" consisted of 52 adult non-smoking patients with established diagnosis of DM Type-2 and Group "B" consisted of 52 normal healthy adult volunteers to conduct the study. All the subjects were elicited of detailed history, and demographic data were collected. All the subjects were investigated by anthropometry, lipid profile, hemoglobin A1c (HbA1c), and spirometric measurements; the measurements included forced vital capacity (FVC), forced vital capacity in 1 second ( $FEV_1$ ),  $FEV_1/FVC$ , forced expiratory flow ( $FEF_{25}$ ,  $FEF_{50}$ ,  $FEF_{75}$ ,  $FEF_{25-75}$ ,  $FEF_{0.2-1.2}$ ) and peak expiratory flow rate. All the data were analyzed using standard statistical methods. Associations between FVC and  $FEV_1$  and HbA1c and duration of illness in diabetic patients were analyzed by applying Pearson's coefficient.

**Observations and Results:** Both the Group A and B patients were matched by age, sex, and anthropometric features. The subjects belonged to the age groups of 40–70 years with a mean age of  $52.48 \pm 3.60$  in Group A and  $53.10 \pm 2.75$  in Group B ( $P > 0.5$ ). There were 28 males and 24 females in Group A. There were 26 males and 26 females in Group B. Group A patients showed a reduction in FVC and  $FEV_1$  when compared to subjects of Group B which was significant. There was no significant difference between forced expiratory ratio and maximum mid-expiratory flow among the two groups. Serum triglyceride (TG) levels were significantly higher in Group A patients ( $P < 0.05$ ).

**Conclusions:** Type-2 DM being an endocrinal systemic disease when affects over a long period may result in a reduction in lung functions caused by restrictive ventilator pathological changes.

**Key words:** Diabetes Type-2, Diabetes, Microangiopathy, Pulmonary functions tests, Pulmonary

## INTRODUCTION

According to the WHO estimates, there are already 180 million people suffering from diabetes mellitus (DM) all over the world and the number is likely to increase by another 180 million by 2030.<sup>[1]</sup> The increase in incidence and prevalence of diabetic population is from Southern

Asia.<sup>[2]</sup> Diabetes being a endocrinal disorder with micro-microvascular changes in many organs presents clinically in various forms and has debilitating effects on the individual as a whole.<sup>[3]</sup> The relation between DM and lung functions is being studied for many years by authors.<sup>[4]</sup> Among them, few authors have noted impaired pulmonary function among the DM patients.<sup>[5-8]</sup> Davis *et al.* among these authors proved that lung is a target organ due to the exposure of fluctuant glycemic levels in patients with DM, especially Type-2. The alveoli of the lung are lined by a capillary network or microvascular unit which is affected in the generalized microangiopathy of DM.<sup>[5]</sup> Due to its large vascular reserve, the substantial loss of vascular network of the lung due to DM may not itself proclaim itself symptomatically for a long time. Hence, pulmonary diabetic

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microangiopathy may be underrecognized clinically.<sup>[9]</sup> The important changes noted by various workers in the lungs of DM patients are reduced elastic recoil, reduced lung volume, diminished respiratory muscle performance, and chronic low-grade inflammation,<sup>[10,11]</sup> decreases in pulmonary diffusion capacity for carbon monoxide,<sup>[12]</sup> and autonomic neuropathy involving respiratory muscles.<sup>[13]</sup> A strong correlation between pulmonary functions and hemoglobin A1c (HbA1c) and chronicity of DM Type-2 was observed by Shah *et al.*<sup>[14]</sup> In the present context, this study was conducted with a hypothesis that pulmonary function testings are affected in DM in Indian population and the changes may correlate with HbA1c and the duration of the disease.

### Institution of Study

This study was conducted in Kannur Medical College, Anjarakandy, Kannur.

### Period of Study

The study period was from October 2011 to September 2014.

## MATERIALS AND METHODS

A total of 104 subjects were included and divided into 2 groups. Group A consisted of 52 non-smoking DM Type-2 patients attending the Department of Medicine out patient department of a tertiary teaching hospital in the Northern Kerala. Group B consisted of healthy non-smoking volunteers' exclusively used as a control group. An ethical committee clearance was obtained from the Institute head, and an ethical committee cleared consent letter was used to collect the data.

### Inclusion Criteria

The following criteria were included in the study:

1. Patients aged above 40 years and below 70 years.
2. Patients with no history of smoking, acute or chronic lung disease.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Patients with complaints of cough, sputum, or dyspnea.
2. Patients with a history of smoking even for 1 month.
3. Patients with surgeries on the chest or lungs.
4. Patients with cardiopulmonary diseases.
5. Patients with musculoskeletal or endocrine diseases.

For Group B, healthy subjects who were non-smokers and in the same identical age group of patients of Group A were included. The subjects were of the same socioeconomic status, and preferably, the relatives of Group A were

included. In Group B subjects, initial fasting and post-prandial blood glucose levels were measured by glucose oxidase method to rule out Type-2 DM in them. Subjects of both groups were elicited of a thorough clinical history followed by anthropometry. Anthropometry included standing height, weight, and body mass index (BMI). Fasting and random blood sugars (RBS) and fasting lipid profile were checked. All the subjects were investigated for lipid profile, HbA1c, and spirometric measurements; the measurements included forced vital capacity (FVC), FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, FEF<sub>25</sub>, FEF<sub>50</sub>, FEF<sub>75</sub>, FEF<sub>25-75</sub>, FEF<sub>0.2-1.2</sub>, and peak expiratory flow rate (PEFR). For all these parameters, percentage of predicted values for the respective age, height, and weight were taken into consideration. All the data were analyzed using standard statistical methods. Associations between FVC and FEV<sub>1</sub> and HbA1c and chronicity of DM were analyzed. HbA1c and lipid profile of all the patients was estimated.

## OBSERVATIONS AND RESULTS

A total of 104 subjects were divided into two groups with 52 subjects in each. Group A consisted of patients under treatment for DM Type-2 lasting for 3–10 years with a mean duration of  $7.12 \pm 1.86$  years. Group B consisted of human volunteers preferable among the relatives of the diabetics of Group A. Among the 52 patients of Group A, there were 28 males and 24 females with a male-to-female ratio of 1.6:1. Among the 52 patients of Group B, there were 26 males and 26 females with a male-to-female ratio of 1:1. The mean age in Group A was  $53.48 \pm 3.60$ , and in Group B, it was  $52.10 \pm 2.75$ . The mean height in group patients was  $134.92 \pm 3.46$ , and in Group B, it was  $139.46 \pm 60$ . These parameters were selected in such a way that they were matching, and hence, were not statistically significant ( $P > 0.05$ ) [Table 1]. Similarly, the BMI was  $28.32 \pm 3.21$  in Group A and  $27.42 \pm 2.41$  in Group B was also not significant [Table 1]. Other anthropometric parameters such as systolic blood pressure, diastolic blood pressure, fasting blood sugar, RBS, low-density lipoprotein, triglycerides (TG), and cholesterol values were significant statistically when compared in both groups and higher in Group A DM Type-2 patients; ( $P < 0.05$ ), [Table 1].

On spirometry, the various test values were tabulated and analyzed in Table 2 showed statistical significance among the subjects of Group A and B. This study showed that the pulmonary parameters, i.e., FVC, FEV<sub>1</sub>, FEF<sub>25</sub>, FEF<sub>50</sub>, FEF<sub>75</sub>, FEF<sub>25-75</sub>, FEF<sub>0.2-1.2</sub>, and PEFR were significantly reduced except FEV<sub>1</sub>/FVC; ( $P = 0.062$ ) in patients of Type-2 DM as compared with the healthy controls ( $P < 0.05$ ), [Table 2].

**Table 1: The demographic data and the anthropometric data of Group A and B subjects (n=104)**

Variables	Group A	Group B	Mean difference (95% of CI)	P
Gender				
Male	28	26		0.632
Female	24	26		
Age in years	53.48±3.60	52.10±2.75	0.38 (-2.83, -3.21)	0.821
Height	164.92±3.46	169.46±3.60	4.54 (-4.60, -0.024)	0.057
Weight	62.15±2.35	67.24±3.85	5.09 (-3.20, -0.0043)	0.061
BMI	27.32±3.21	26.42±2.41	1.0 (0.9, -2.432)	0.31
Systolic B.P	141.74±18.31	124.75±17.60	16.99 (11.24, 20.50)	0.010
Diastolic B.P	85.20±8.76	79.98±9.15	5.22 (0.24, -7.14)	0.025
FBS	174.0±53.65	101.40±8.78	72.6 (46.14, -76.86)	0.019
RBS	218.50±79.64	111.75±20.43	106.75 (78.42, -128.76)	0.005
LDL	111.94±27.23	120.82±24.25	-8.88 (-19.84, -0.214)	0.05
TG	194.12±98.43	132.0±53.0	62.12 (26.65, -95.43)	0.021
Cholesterol	183.20±27.60	194.53±30.42	-11.33 (-21.55, -1.20)	0.049
HbA1c	7.12±1.36	-	-	-
Duration of DM	7.12±1.86	-	-	-

DM: Diabetes mellitus, HbA1c: Hemoglobin A1c, TG: Triglycerides, LDL: Low-density lipoprotein, RBS: Random blood sugars, FBS: Fasting blood sugar, B.P: Blood pressure, BMI: Body mass index, CI: Confidence interval

**Table 2: The pulmonary function tests in both groups of the study (n=104)**

Observations mean values	Group A	Group B	Mean difference (95% CI)	-
FVC	2.49±0.67	2.94±0.92	-0.45 (-0.61, -0.06)	0.02
FEV <sub>1</sub>	2.06±0.85	2.19±0.72	-0.13 (-0.49, -0.003)	0.04
FEV <sub>1</sub> /FVC	85.05±7.93	84.99±7.21	0.056 (-2.32, -0.013)	0.62
PEFR	79.40±10.32	58.24±3.48	21.16 (09.15, -0.045)	0.043
FEF <sub>25</sub>	80.37±6.88	61.80±17.26	18.57 (10.32, 11.23)	0.038
FEF <sub>50</sub>	q	62.62±18.13	-	0.031
FEF <sub>75</sub>	86.10±11.34	63.05±21.86	23.05 (09.21, -1.32)	0.028
FEF <sub>25-75</sub>	75.43±11.12	69.42±22.42	6.01 (04.20, -9.34)	0.041
FEF <sub>0.2-1.2</sub>	92.15±1.56	71.38±24.68	20.77 (11.32, -6.15)	0.037
SVC	2.76±0.82	2.92±0.66	0.16 (-0.58, -0.014)	0.04
MMEF	2.89±1.54	2.52±0.89	0.37 (-0.40, -0.392)	0.86

MMEF: Maximum mid-expiratory flow, SVC: Slow vital capacity, FEF: Forced expiratory flow, PEFR: Peak expiratory flow rate, FEV<sub>1</sub>: forced vital capacity in one second, FVC: Forced vital capacity, CI: Confidence interval

## DISCUSSION

The effect of chronicity of DM Type-2 on pulmonary functions in the adult population was theoretically explained due to several pathological changes that occur in the lungs. Ljubić *et al.*<sup>[15]</sup> in his study showed that, due to collagen and elastin, changes occurring in the lung leads to pulmonary complications. Another theory was that due to chronic high circulating glucose levels there would be increased non-enzymatic glycation of proteins and peptides of the extracellular matrix resulting in pathological changes of the lungs in DM Type-2 patients.<sup>[16]</sup> The present study showed that there was a definite reduction in pulmonary functions in DM Type-2 patients. The results analyzed in this study showed that there was a significant reduction in FVC, FEV<sub>1</sub>, and slow vital capacity (SVC) values, relative to their matched controls. However, FEV<sub>1</sub>/FVC was less in diabetics but was statistically not significant [Table 2]. Similarly, the pulmonary function values of Group A patients in relation to FEF<sub>25</sub>, FEF<sub>50</sub>, FEF<sub>75</sub>, FEF<sub>25-75</sub>, FEF<sub>0.2-1.2</sub>, and PEFR were also reduced in comparison to

the control group subjects [Table 2]. In a meta-analysis by van den Borst *et al.*,<sup>[17]</sup> it was observed that the association between DM Type-2 and impaired pulmonary function was significant but in a restrictive pattern and the results were irrespective of the body weight, height, BMI, and HbA1c levels of the subjects. Even though pulmonary perfusion scintigrams are not done in this study, but as a part of the discussion, the study by Uchida *et al.*<sup>[18]</sup> needs to be mentioned here which showed decreased pulmonary diffusing capacity in patients with diabetes with perfusion defect. In a large community-based study by Davis *et al.*<sup>[4]</sup> in Western Australia among DM Type-2 patients, VC, FVC, FEV<sub>1</sub>, and PEF were decreased. It was also suggested in the study that the reduced lung volumes and airflow limitation are likely to be chronic complications of Type-2 diabetes. In a study in Japan by Asanuma,<sup>[19]</sup> it was reported that FVC and FEV<sub>1</sub> were reduced in DM Type-2 subjects compared to control subjects. In a study by Ehrlich *et al.*,<sup>[20]</sup> it was observed that there was an increased risk of several pulmonary conditions such as asthma, chronic obstructive pulmonary disease, fibrosis, and pneumonia in patients

with Type-2 DM. The histopathological changes causing a reduction in pulmonary functions of DM Type-2 patients as reported by few authors were due to basal lamina thickening<sup>[21]</sup> and fibrosis.<sup>[22]</sup> Clinically, these pathological changes manifest in the form of a reduction in elastic recoil of the lung, lung volumes, and pulmonary capacity for the diffusion of carbon monoxide.<sup>[23]</sup> In the present study, there was a prevalence of high levels of TG as compared to control group subjects which was not found in other studies in the literature. Significant reduction in pulmonary function tests in this study was observed in Group A patients which was significantly higher than the control subjects of Group B, but no significant reduction in FVC/FEV<sup>1</sup> ratio strongly suggests a restrictive pattern of pulmonary dysfunction. Studies also have shown that diabetic polyneuropathy, which affects respiratory neuromuscular function and thus reducing pulmonary volumes.<sup>[24]</sup> The present study has a few limitations, as the study is small and hospital-based study, the results cannot be attributed to the community.

## CONCLUSIONS

Type-2 DM being an endocrinal systemic disease when affects over a long period may result in a reduction in lung functions caused by restrictive ventilator pathological changes. The pulmonary functions affected are VC, FVC, FEV<sub>1</sub>, SVC, maximum mid-expiratory flow, and PEF FVC/FEV<sup>1</sup> ratio being unaffected.

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# Study of Nuclear Hardness and Phaco Time in Phacoemulsification

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## Abstract

**Introduction:** Hardness of the cataractous lens is one of the major factors influencing the suitability of a patient for phacoemulsification. Phacoemulsification machines can measure the average phaco power and the phaco time (the amount of total time spent on the foot pedal at position 3). Effective phaco time (EPT) is a parameter that allows us to compare different phaco settings. EPT can be considered the product of phaco time multiplied by average phaco power.

**Purpose:** This study was undertaken to correlate the grade of nuclear hardness (graded according to lens opacities classification system III [LOCS III]) with the phaco time (both total and effective) in phacoemulsification, by recording the grade of nuclear cataract and the phaco time during each surgery.

**Materials and Methods:** In this study, 50 eyes undergoing phacoemulsification were studied. All cases were operated on using the same machine and under similar operative conditions. Nuclear hardness was graded according to color as seen under the slit lamp in accordance to the LOCS III grading system. In all the cases, the nucleus was then phacoemulsified using the stop and chop technique. The total phaco time and the EPT displayed on the phaco machine panel were noted carefully for each case.

**Results:** Nuclear hardness was graded based on LOCS III. Of the 50 eyes studied, 9 were of Grade 1, 16 were of Grade 2, 19 were of Grade 3, 5 were of Grade 4, and 1 was of Grade 5. Individual EPT for each case was charted against grades of nuclear cataract. The mean and standard deviations for Grades 1, 2, 3, and 4 were 0.2244, 0.7825, 1.80737, and 2.874, respectively, and 0.04096, 0.42399, 0.59038, and 0.36957, respectively. *P* value for the above as calculated using one-way ANOVA was 0.00, which is significant.

**Conclusion:** In this study, EPT varies significantly with different grades of nuclear sclerosis.

**Key words:** Cataract, Effective phaco time, Lens opacities classification system, Phacoemulsification, Phaco time

## INTRODUCTION

Phacoemulsification machines can measure the average phaco power and the phaco time (the amount of total time spent on the foot pedal at position 3). The absolute amount of phaco energy delivered into the eye at 100% power, known as absolute phaco time (APT). Effective phaco time (EPT) is a parameter that allows us to compare different phaco settings. It is calculated by multiplying

the total phaco time by the percentage power used and represents how long the phaco time would have been if 100% power, continuous mode had been utilized. More specifically, EPT can be considered the product of phaco time multiplied by average phaco power. A low APT results in clearer cornea and sharper vision on the first post-operative day, thus achieving a high patient satisfaction rate, lower corneal endothelial cell loss, lesser corneal decompensation, and a dramatically reduced incidence of pseudophakic bullous keratopathy. Hardness of the cataractous lens is one of the major factors influencing the suitability of a patient for phacoemulsification. This study was undertaken to correlate the grade of nuclear hardness (graded according to LOCS III) with the phaco time (both total and effective) in phacoemulsification, by recording the grade of nuclear cataract and the phaco time during each surgery.

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## MATERIALS AND METHODS

In this study, 50 eyes undergoing phacoemulsification were studied. All cases were operated on using the same machine and under similar operative conditions. Inclusion criteria: Patients with clear cornea, normal anterior chamber depth, and intact zonules were included in the study. Exclusion criteria: Patients with corneal pathology, shallow anterior chamber, raised intraocular pressure, complicated cataract, traumatic cataract, eyes with evidence of glaucoma or fundus pathology, zonular dialysis, and small pupil were excluded from the study.

The clarity of the anterior chamber was confirmed in all cases and any obvious pathology was ruled out. The iris color, being related to dilatation of the pupil, was graded carefully preoperatively. The maximum pre-operative pupillary diameter was measured with the horizontal slit of the slit lamp. The nuclear hardness being the most important determinant in phacoemulsification was graded carefully. The low magnification view of the slit lamp with slit beam oriented at 45° to the patient's visual axis was used. The slit height exceeded slightly the diameter of the pupil and the width was adjusted so that the overall brightness of the slit image was good. Nuclear hardness was graded according to color as seen under the slit lamp in accordance to the LOCS III grading system. If the cortex was very hazy, the brightness of the beam was increased to gain penetrance into the lens substance. The irrigating solution used in all cases was standard balanced salt solution. The bottle was hung at an approximate height of 60 cm above the patient, and the tubing was connected to the phacoemulsifier probe through a sterile silicone tube which was passed through the pinch roller mechanism after passing through a pinchcock mechanism meant to cut off the flow. The phaco tip was then connected by a separate (inbuilt) wiring to the ultrasound generator through the adapter provided. Using the foot switch, the irrigation-aspiration mode was tested. Using the silicone tuning chamber, the ultrasound tip was tuned.

All standard pre-operative investigations of sac patency, intraocular tension, biometry, blood pressure, blood sugar (fasting and postprandial), and routine examination of urine were done. Patients with any abnormality in the above-mentioned investigations were excluded from the study.

Preoperatively, the patients were given tropicamide 1% with phenylephrine 2.5% eye drops (1 drop every 20 min, 3 times, about 90 min before surgery). Ketorolac 0.5% eye drops (1 drop every 15 min, 3 times) were given to sustain the pupillary dilatation and to minimize post-operative cystoids macular edema.

Anesthesia constituted peribulbar block with 2% xylocaine and 1:200,000 adrenaline and hyaluronidase with no. 22, 1.5 inches hypodermic needle.

Thorough cleansing of the brow region and lids with 10% povidone-iodine solution was done. Topical 5% povidone-iodine solution was instilled 5 min before surgery.

About 3.2 mm clear corneal incision was made using keratome blade and anterior chamber was entered. Continuous curvilinear capsulorhexis was carried out using 26-G bent needle and Utrata forceps. This was followed by hydrodissection and hydrodelineation of the nucleus. The nucleus was then phacoemulsified using the stop and chop technique: Using power based on the grade of nucleus, a central longitudinal trench was created with the 15° phaco tip in continuous mode. It was deepened by making successive passes toward 6 o'clock till red reflex was clearly visible. The trench was widened enough to allow access to successive deeper layers of the nucleus. The second instrument was used to avoid excessive nuclear movements while trenching. The nucleus was then rotated 180° and trenched in the opposite direction to get a trench of equal depth in both directions. The thinned out posterior plate was cracked to divide the nucleus into two hemisections by inserting the phaco tip and chopper into the depths of the groove and moving them in opposite directions. Once the nucleus was cracked into two further trenching was stopped and the two heminuclei were chopped. The phaco tip in pulse mode was then embedded at the junction of one-third and two-third of the heminucleus, and then, vacuum alone was used to hold the nucleus. The chopper was then embedded and was used to separate one-third of the nucleus from the remainder. This was repeated to split the remaining two-third into two. Three nuclear fragments were thus obtained. These three fragments were then removed using pulse mode, and similarly, the second heminucleus was chopped and removed. Any cortical matter left was aspirated, and foldable posterior chamber intraocular lens was implanted using a viscoelastic substance. The viscoelastic substance was then washed out.

The total phaco time and the EPT displayed on the phaco machine panel were noted carefully for each case.

Postoperatively, all patients were put on tapering dose of topical antibiotic and steroid combination for 6 weeks. Patients were followed up at 1<sup>st</sup>, 2<sup>nd</sup>, and 6<sup>th</sup> weeks postoperatively.

All details were compiled in individual case pro forma and a master chart with all studied parameters was prepared.

## RESULTS

Of the 50 eyes operated on for cataract by phacoemulsification, 23 cases were from 51 to 60 years age group, 13 cases were from 61 to 70 years age group, 11 cases were from 41 to 60 years age group, and 3 cases were from 71 to 80 years age group [Figure 1]. Nuclear hardness was graded depending on nuclear color and opalescence based on LOCS III. Of the 50 eyes studied, 9 were of Grade 1, 16 were of Grade 2, 19 were of Grade 3, 5 were of Grade 4, and 1 was of Grade 5 [Figure 2]. The average age of patients with different nucleus grades was calculated. Those having Grade 1 nuclear cataract had an average age of 49.7 years, Grade 2 nucleus was seen in average age of 56.25 years, Grade 3 in 61.9 years, Grade 4 in 69.6 years, and Grade 5 in 75 years of age [Figure 3]. The average total phaco time for each nuclear grade was calculated. It was found to be 1.26, 2.42, 4.12, 5.02, and 8.23 min for Grades 1, 2, 3, 4, and 5, respectively [Figure 4]. Individual EPT for each case was charted against grades of nuclear cataract.

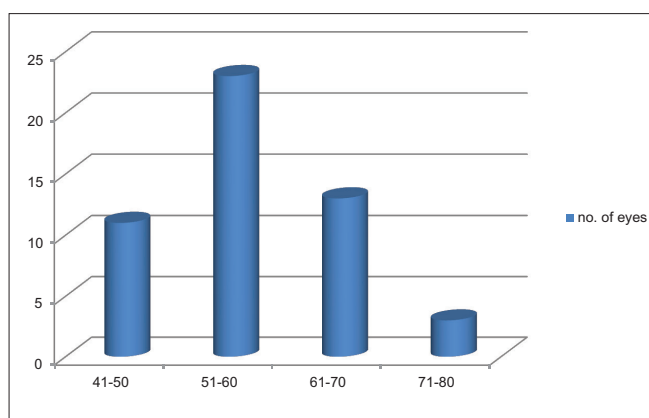


Figure 1: Age distribution of cataract

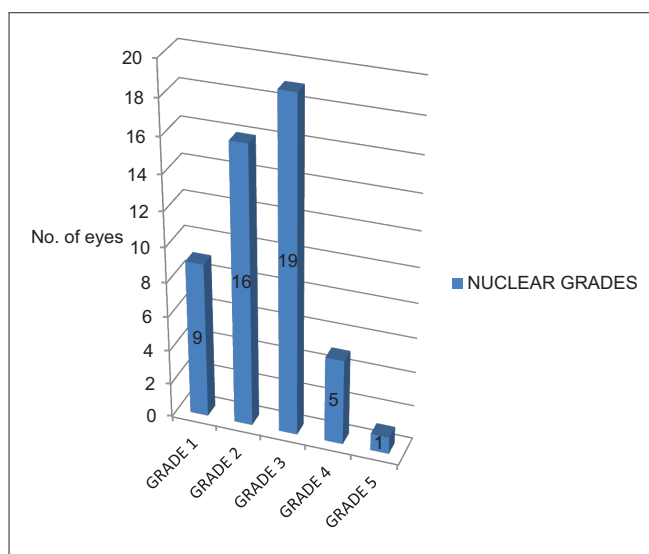


Figure 2: Nuclear hardness distribution

The mean and standard deviations for Grades 1, 2, 3, and 4 were 0.2244, 0.7825, 1.80737, and 2.874, respectively, and 0.04096, 0.42399, 0.59038, and 0.36957, respectively [Figure 5]. *P* value for the above as calculated using one-way ANOVA was 0.00, which is significant.

## DISCUSSION

In eyes, this study a total of 50 eyes, with varying grades of nuclear cataract underwent phacoemulsification. All eyes were thoroughly evaluated preoperatively and the nature of the cataract was studied. Nuclear hardness graded at the slit lamp with respect to total phacoemulsification time of 4.12 min. The average phacoemulsification time increasing with respect to increasing grades of hardness Heyworth *et al.*<sup>[1]</sup> stated that lens hardness is probably the most important single factor and is associated with increased phaco time and power. According to Chylack *et al.*,<sup>[2]</sup> there is a well-known but poorly quantified clinical relationship between nuclear color and ease of phacoemulsification. This study has tried to define this relationship by correlating the increasing nuclear hardness to higher phacoemulsification time, both total and effective

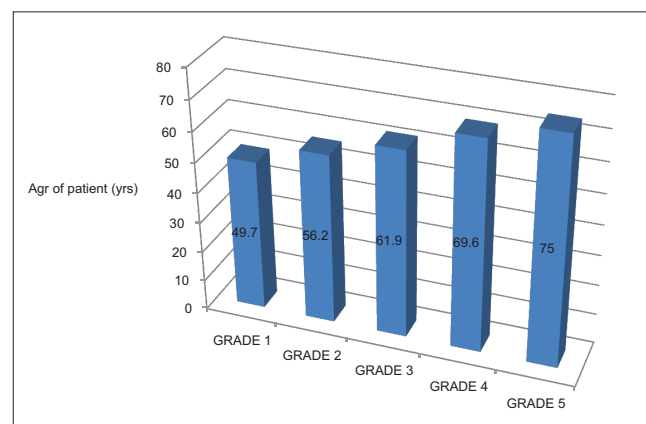


Figure 3: Age of patient compared to nuclear grade

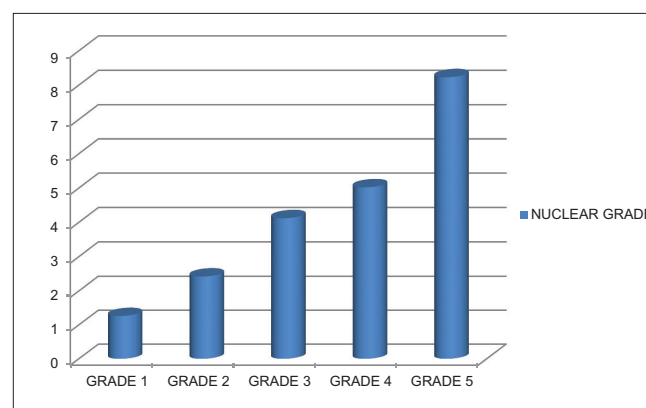
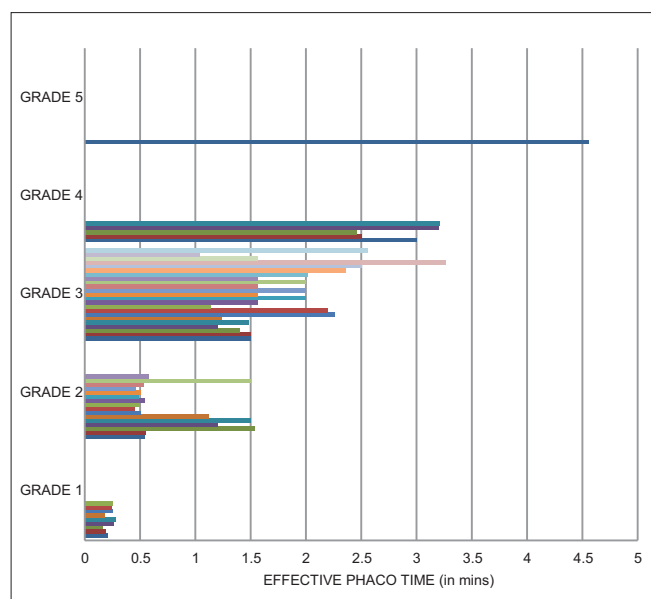


Figure 4: Nuclear grades compared to average total phaco-time



**Figure 5: Grades of nuclear cataract and effective phaco time**

Tabandeh *et al.*,<sup>[3]</sup> stated that assessment of hardness of a cataractous lens is a factor which influences the suitability of patient for phacoemulsification. Their study demonstrated that hardening of the lens nucleus is associated with coloration and advancing age. However, Gullapalli *et al.*<sup>[4]</sup> in their study have said that color is a better and reliable marker for nuclear hardness, diameter, and central thickness as compared to age. In this study, nuclear color was relied on to grade cataract. Age was taken into consideration but was only a secondary factor. All cataracts in this study underwent the same procedure without any variation of

technique. Stop and chop technique of emulsifying nucleus was always undertaken. According to Howard V. Gimbel<sup>[5]</sup> variations of the basic technique should be adapted as one operates on nuclei of higher grades. It is obvious from this study that one nucleus of Grade 5 took 8.23 min to phacoemulsifier; as no variation was undertaken. Hence, for cataracts of Grades 4 and 5 nuclear hardness, a technique that decreases phacoemulsification time such as phaco chop should be adopted.

## CONCLUSION

Phacoemulsification is an excellent procedure with gratifying results, if extreme care is taken with proper patient selection. The ease of the procedure depends on the hardness of the nucleus. In this study, it was noted that the EPT varied significantly with different grades of nuclear sclerosis.

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# Intradural Extramedullary Spinal Cord Tumors: Surgical Outcome in a Newly Developed Tertiary Care Hospital

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## Abstract

**Background:** Intradural extramedullary tumors constitute nearly 65% of all spinal tumors. Over the years there has been dramatic improvement in diagnostic and therapeutic modalities especially the improvised surgical techniques.

**Materials and Methods:** Outcome of 23 patients was analyzed with respect to symptom improvement following surgery, at 1 month and later at 6 months.

**Results:** Overall, nearly 75% patients showed excellent results as per Frankel grading system, while as 8% and 17% had shown good and fair response, respectively.

**Keywords:** Intradural extramedullary, Spinal tumors, Tertiary hospital

## INTRODUCTION

Primary spinal cord tumors constitute 2–4% of all central nervous system neoplasms. They are characterized based on their location as extradural, Intradural extramedullary (IDEM), and intramedullary tumors.<sup>[1]</sup> IDEM tumors are rare central nervous system tumors that are found only in 0.3 out of 100,000 patients each year.<sup>[2,3]</sup> [Figure 1].

The most common IDEM tumors are derived from sheath cells covering the spinal nerve roots (schwannoma and neurofibroma) or meningeal cells located along the spinal cord surface (meningiomas). Myxopapillary ependymomas are extramedullary tumors arising from the conus medullaris and filum terminalis. Less common

IDEM lesions include hemangiopericytomas, lipomas, paragangliomas, epidermoid cysts, arachnoid cysts, and dermoid cysts.<sup>[4]</sup>

Patients with IDEM tumors often present with symptoms of spinal cord compression.<sup>[5]</sup> Local or radicular pain is the most common presenting symptom and had the highest incidence in tumors located in the region of lumbar spine.<sup>[3]</sup> Pain is followed by motor deficits, sensory loss and last but not the least is the sphincter dysfunction.<sup>[6]</sup>

Magnetic resonance imaging (MRI) is the investigation of choice for diagnosis of IDEM tumors. It is not only preferred method for detail radiological assessment of tumors but also can even suggest histological subtype.<sup>[7]</sup> Magnetic resonance angiography or spinal angiogram can be beneficial if the tumor has a vascular component.<sup>[4]</sup>

Surgical excision is the best treatment modality in almost all patients with symptomatic IDEM lesions. Gamma knife is reserved for cases in which surgery could not be done due to various risks.<sup>[8]</sup> The results of surgical excision of IDEM tumors have improved in past few decades

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due to development of more precise diagnostic tools such as computed tomography, MRI for understanding the anatomical structures, and with the advancement of surgical instruments and techniques especially with the use of high-resolution intraoperative microscopes.<sup>[9]</sup>

The aim of this study was to impress on the excellent surgical outcome of IDEM tumors when performed under high-resolution microscope by young neurosurgeons in their initial learning curve of their surgical experience.

## MATERIALS AND METHODS

This retrospective study was conducted in the Department of Neurosurgery of a newly started tertiary care Super Speciality Hospital of Government Medical College, Jammu, Jammu and Kashmir, India. All the patients were admitted to neurosurgery department of this hospital. Patients were evaluated for clinical symptoms and duration of symptoms, neurological examination and radiological evaluation by contrast MRI of the spine was done. All the patients operated with the diagnosis of IDEM lesions were included in the study.

A total of 23 patients included in this study were operated in 2 years with effect from July 1 2014 to June 30 2016. All the patients were operated by performing laminectomy with excision of tumor through posterior approach alone irrespective of location and position of tumor. After a midline incision and performing laminectomy, longitudinal incision was made in the dura, tumor detached and removed.

The outcome of all the operated patients were compared, based on the preoperative “Frankel grade” [Table 2] and sphincter disturbance with that of post-operative Frankel

grade and sphincter control at 1 month and then at mean follow-up period of 6 months.

## RESULTS

We in our department have operated 23 patients with pre-operative diagnosis of IDEM spinal cord tumors in a period of 2 years. Out of 23 patients, 13 (56.52%) were male, and 10 (43.48%) were female. All of them were clinically evaluated preoperatively and assessed based on Frankel grading system and for Sphincter control. All the patients were operated by performing a midline skin incision, laminectomy with excision of tumor through posterior approach alone irrespective of location and position of tumor. The post-operative period was uneventful in all the cases. None of the patient required posterior stabilization.

The most common site of lesions on MRI in our study was dorsal in 11 (47.86%) followed by cervical in 4 (17.39%), dorsolumbar in 4 (17.39%), lumbar in 3 (13.04%), and Cervicodorsal junction in 1 (4.34%) patient [Table 1]. Pain, local or radicular was seen in almost all the patients admitted with a diagnosis of IDEM tumors. Myelopathic features were seen in 11 (47.82%), and Sphincter control (bowel/bladder) was lost in 11 (47.82%) patients especially in conus medullaris and cauda equine tumors.

Histopathology reports have confirmed the diagnosis of schwannoma in 10 (43.48%), meningioma in 4 (17.39%), neurofibroma in 3 (13.04%), ependymal cyst in 2 (8.69%), lipoma in 2 (8.69%), Arachnoid cyst in 1 (4.34%), and ganglioneuroma in 1 (4.34%) patients.

All the patients were put on IV antibiotics for initial 5 days and were discharged after removal of stitches on 7–8<sup>th</sup> post-operative days. Local wound infection and cerebrospinal fluid leak was seen in 2 patients, and both were managed conservatively. We followed all the patients for initially at 1 month and later at 6 months for post-operative recovery of motor/sensory deficits based on Frankel grading and for the sphincter control.

We have observed that 17 (74%) out of 23 operated patients had shown overall excellent outcome, 2 (8%) patient had shown good, and 4 (18%) patients had shown fair outcome [Figure 2].

Excellent result means Frankel E with normal sphincter control, good outcome we have taken as partial recovery and Fair grade as clinical insignificant recovery. 9 out of 10 patients with the diagnosis of schwannoma showed excellent results, and all the 4 patients with the diagnosis of meningioma, clinically improved on 6 months follow-up.



**Figure 1: Magnetic resonance images of intradural extramedullary at cervical region**

## DISCUSSION

Primary spinal cord tumors constitute 2–4% of all central nervous tumor neoplasm and they are characterized based on their location as extradural, IDEM, and intramedullary.<sup>[1]</sup> Patients with spinal cord tumors can present with radiculopathy, myelopathy, neck pain, back pain and maybe the sphincter involvement.<sup>[6]</sup>

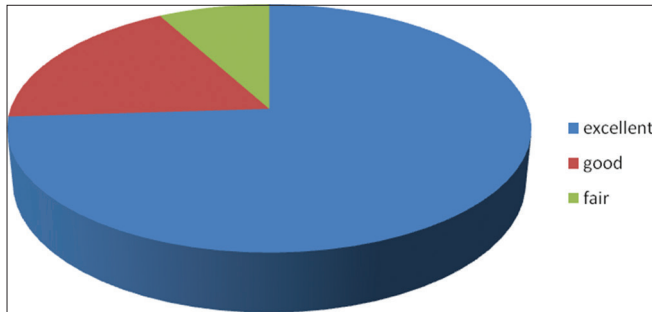


Figure 2: Pie chart depicting response rates

We are presenting 23 cases of IDEM spinal cord tumors which were operated in our department over a period of 2 years with effect from July 1 2014 to June 30 2016. These patients were followed up initially on monthly follow-up and later at 6 months to see the sensory and motor recovery and of course the sphincter recovery in those patients who presented with sphincter involvement initially.

IDEM tumors commonly seen are schwannomas, neurofibromas, and meningiomas. Less common tumors include metastatic deposit, paragangliomas, lipomas, nerve sheath myxomas, and vascular tumors.<sup>[3]</sup>

In our study out of 23 operated patients with pre-operative diagnosis of IDEM tumors, 10 were Schwannomas, 4 were Meningiomas, 3 were Neurofibromas, 2 were Myxopapillary Ependymoma, 2 were Lipomas, and 1 Arachnoid cyst [Table 1], as confirmed on histopathology report.

Table 1: Patient characteristics and treatment response

Age/ sex	Chief complaint	Pre-operative diagnosis	Pre-operative Frankel	Level	Pre-operative sphincter control	Procedure done	Post-operative Frankel	Post-operative Sphincter control	Result
42/F	MW, RS	Meningioma	C	D6	Present	LE	E	Present	Excellent
50/F	MW, RS, SD	Meningioma	B	D8-D9	Absent	LE	E	Present	Excellent
65/M	RS	Schwannoma	D	C2	Present	LE	E	Present	Excellent
32/F	MW, RS, SD	Ependymal cyst	B	D12-L3	Absent	LE	D	Absent	Good
26/M	RS, SD	Schwannoma	D	L2	Absent	LE	E	Present	Excellent
45/F	MW	Schwannoma	C	D6	Present	LE	E	Present	Excellent
22/M	MW, SD	Arachnoid cyst	B	D8	Absent	LE	E	Present	Excellent
33/F	RS	Schwannoma	D	D7	Present	LE	E	Present	Excellent
52/F	MW, RS, SD	Ependymal cyst	B	D12-L2	Absent	LE	C	Absent	Fair
50/M	RS, SD	Schwannoma	D	D7-D9	Absent	LE	E	Present	Excellent
55/M	RS	Schwannoma	D	L5-S1	Present	LE	E	Present	Excellent
54/M	MW, RS, SD	Ganglioneuroma	B	D12-L1	Absent	LE+Fixation	B	Absent	Fair
22/M	RS	Schwannoma	D	C2-C3	Present	LE	E	Present	Excellent
65/M	MW, RS, SD	Schwannoma	C	D4-D5	Present	LE	E	Present	Excellent
45/M	MW, RS	Meningioma	C	C5-C6	Present	LE	E	Present	Excellent
60/M	RS, SD	Lipoma	D	L3-L5	Absent	LE	E	Present	Excellent
36/F	MW, RS, SD	Schwannoma	C	D9-D10	Absent	LE	D	Absent	Fair
23/F	RS, SD	Lipoma	D	D12-L5	Absent	LE	D	Absent	Fair
50/F	RS	Meningioma	D	C7-D1	Present	LE	E	Present	Excellent
43/M	RS	Neurofibroma	D	C5-C6	Present	LE	E	Present	Excellent
49/F	RS	Neurofibroma	E	D7	Present	LE	E	Present	Excellent
51/M	MW, RS, SD	Neurofibroma	C	D9	Absent	LE	D	Absent	Good
40/M	RS	Schwannoma	E	D3-D4	Present	LE	E	Present	Excellent

MW: Motor weakness, RS: Radicular symptoms, SD: Sphincter disturbance

Table 2: Frankel grading system\*

Grade A	Complete neurological injury	No motor or sensory function detected below level of lesion
Grade B	Preserved sensation only	No motor function below level of lesion, some sensory function below level of lesion detected
Grade C	Preserved motor, non-functional	Some voluntary motor function preserved below level of lesion but too weak to serve any useful purpose, sensation may or may not be preserved
Grade D	Preserved motor, functional	Functionally useful voluntary motor function below level of injury is preserved
Grade E	Normal motor function	Normal motor and sensory function below level of lesion, abnormal reflexes may persist

\*van Middendorp JJ, Goss B, Urquhart S, *et al.* Diagnosis and prognosis of traumatic spinal cord injury. *Global Spine J* 2011;1:1-8

### Schwannomas

Schwannomas are nerve sheath tumors that arise from dorsal nerve root. They are considered as benign, but the malignant schwannomas do exist. These neoplasm histologically arise from myelin-producing Schwann cells and have two types of cells called Antoni A and Antoni B which contribute to their imaging characteristics.<sup>[10]</sup>

Patients with schwannoma present in 4–6<sup>th</sup> decade of life. High risk of malignant schwannomas is seen in patients with a diagnosis of neurofibromatosis Type II that too in young age. Patients with schwannomas are usually asymptomatic as the lesions are found incidentally on MRI. Many patients present with mild sensory symptoms such as shooting pain and paresthesias, while few may present with motor deficits.<sup>[5,6]</sup>

MRI is the imaging method of choice to evaluate the lesion. On MRI, schwannoma appear as solid tumors in the dorsal sensory root region, which may displace spinal cord, conus medullaris, or filum terminale.<sup>[1]</sup> Schwannomas appear isointense on T1W images as hyperintense on T2W images.

In our study out of 23 operated patients, 10 were histologically diagnosed as schwannomas. Out of these 10 patients, 6 were male, and 4 were female. As per location, 2 patients had cervical, 6 patients had dorsal, and 2 patients had lesion in lumbar spine. Common clinical presentation in our study was pain with radicular symptoms (RS). All the patients underwent midline skin incision, laminectomy with total excision. Our results were consistent with most of the studies in the literature,<sup>[7–10]</sup> as in our series of 9 out of 10 operated patients they showed excellent outcome after a mean 6 months of follow-up. One young female patient who had a lesion at D9-D10 showed fair outcome as there was no significant improvement in terms of motor and bladder recovery.

### Neurofibroma

Neurofibromas are benign tumors that arise from peripheral sensory nerves. There are two types of neurofibromas one is called solitary and other one as plexiform. In contrast to schwannomas, neurofibromas encase nerve roots rather than displacing them. Pain and paresthesias are the most common presenting symptoms. Type I neurofibromatosis (NF 1) may have multiple neurofibromas that may increase in number and size with increasing age of patient. On MRI imaging, neurofibromas appear as round or fusiform tumors that are isointense on T1W images and hyperintense on T2W/FLAIR images. The neurofibromas intensely enhance on contrast.<sup>[7]</sup> Total surgical resection is primary treatment. To obtain this, the ventral and the dorsal roots are commonly sacrificed; however, the resection of nerve root is usually not associated with pronounced post-operative

motor or sensory deficits.<sup>[2]</sup> Tumor recurrence is <5% and might be associated with subtotal tumor resection.<sup>[8]</sup> We operated total of 3 patients with histologically proven neurofibromas. One patient was male and two were female. One patient had tumor in cervical region and 2 in dorsal. Out of 3 operated patients, 2 showed excellent outcome whereas one had shown good outcome on mean follow-up.

### Meningiomas

Spinal meningiomas constitute up to 46% of spinal neoplasm and are common IDEM lesions. Thoracic is the most common site (80%).<sup>[12]</sup> Out of four cases we operated for meningiomas, 3 were dorsal, and one cervical, the case with cervical meningiomas was having NF-2. Majority of meningiomas are detected between fifth and seventh decade of life.<sup>[5]</sup> Meningioma arise from arachnoid cap cells embedded in dura near the nerve root sleeve, reflecting their predominant lateral location and meningeal attachment. Meningiomas may arise occasionally from dura or pia.<sup>[5]</sup>

We have operated 4 patients, out of which one was male (25%) and three female (75%). In the literature available, meningiomas are common in female patients,<sup>[12]</sup> even in our study 3 out of 4 were female. Posterior laminectomy provides adequate exposure for spinal meningiomas in most of the cases. Unilateral laminectomy with facetectomy can be used for ventral tumors. Costotransversectomy or lateral extra cavity approach may be utilized for ventral thoracic tumors. We have excised all the four meningiomas by posterior midline laminectomy with complete excision of tumors in all the 4 cases. All patients showed excellent (Frankel E) outcome.

### Ependymal Cyst

Filum ependymomas have been classified as intramedullary lesions by virtue of the neuroectodermal derivative of filum, but as per anatomical and surgical prospective it is grouped under IDEM tumors.<sup>[13]</sup> Myxopapillary ependymomas account for roughly 40–50% of spinal ependymomas.<sup>[13]</sup> Myxopapillary ependymomas arise in the filum terminalis and account for more than 80% of ependymomas found in the cauda equina.<sup>[5]</sup> They are benign well-circumscribed tumors. On MRI they appear as well-circumscribed hypointense lesion on T1, hyperintense on T2 and homogenous enhancement on gadolinium contrast. Ependymal rosettes and perivascular pseudorosettes with characteristic deposition of myxoid material around blood vessels are characteristic of histopathology in ependymomas.

Total excision of ependymal cyst is feasible if the nerve roots in the cauda equine are not entrapped within the tumour.<sup>[14]</sup> We operated two patients with the diagnosis of

ependymal cyst, and both of these patients were having lesions at conus medullaris. Sphincter involvement was seen in both of these female patients. Even after 6 months of regular follow-up in both the patients, there was only some improvement of motor power in one patient but no improvement in sphincter control in both the patients

### Lipoma of Cord

Lipoma of spinal cord is commonly seen by pediatric age group. They are rare tumors of spinal cord and cause symptoms secondary to compression (pain) or due to compressive myelopathy (motor deficits). Intramedullary lipomas involve the cervical and dorsal cord. IDEM lipomas are usually located in the lower thoracic and lumbosacral levels.<sup>[15]</sup> Conus medullaris is the common site of lipomas and may present as lipomyelomeningocele. It is the most common form of the fatty masses in the spine and can be divided into dorsal, caudal, and transitional forms. These lesions are manifestation of occult spinal dysraphism and a common cause of tethered cord syndrome (TCS).<sup>[16]</sup> Timely surgical intervention prevents significant neurological deficits. We operated one male and one female patient with a diagnosis of lipoma of cord. None of these patients have associated TCS or spinal bifida. One has lesion from L3 to L5 levels and the other one from D12 to L5 spinal levels. Both of patients were having Frankel D before surgery and on follow-up only one patient showed a bit neurological improvement.

### Paranglioma

Parangliomas are derived from autonomic-nervous-system paraganglion cells and less common in CNS. Spinal paragangliomas are generally non secreting sympathetic neoplasms which tend to occur in fourth to fifth decade of life and show a male predominance. Intradural paragangliomas are most commonly located in cauda equine and lumbar region.<sup>[17-19]</sup> On MRI paragangliomas are characteristically hypervascular, and after contrast, these tumors show typical salt and pepper pattern.<sup>[20]</sup>

We have operated only one patient with dorsolumbar paraganglioma which was confirmed on histopathology. 54-year-old male patient presented with motor weakness, left-sided radicular pain and bladder involvement. The lesion was located at D12-L1 spinal level. The lesion was eroding the D12 pedicle on the left side, so excision of tumor with fixation D11-L1 spine was done. Patient has not shown any clinical improvement in the motor deficit and sphincter control even after 6 month follow-up.

### Arachnoid Cyst

Intradural spinal arachnoid cysts are the rare causes of spinal cord compression. Basically congenital collections of CSF contained within the arachnoid membrane and subarachnoid space. As the cyst expands, it causes progressive

compression of spinal cord. Usual age of presentation is adolescents and young adults more commonly seen in males. Commonly seen in mid and lower thoracic spine. Patients present with spastic quadriplegia or paraparesis. Other symptoms such as backache, radiculopathy, sensory impairment, and sphincter disturbance may occur. MRI is an investigation of choice. Laminectomy with excision of cyst is the treatment in small arachnoid cysts, and cystoperitoneal shunt placement is required in cysts involving multiple spinal segments. We operated only one young male patient with MRI documented arachnoid cyst at D8 level. Patients pre-operative Frankel has improved from B to E with excellent outcome. We did laminectomy and excision of arachnoid cyst.

## CONCLUSION

1. Spinal cord tumors are uncommon cause of back pain, cervical pain, RS, myelopathy, and sphincter (bowel/bladder) dysfunction.
2. 60% of spinal cord tumors are extradural and 30% are intradural.
3. IDEM tumors constitute 65 % of all primary intra spinal tumors.
4. Pre-operative diagnosis on MRI, detailed clinical assessment and accurate surgical plan is always associated with excellent outcome.
5. All the patients with diagnosis of IDEM tumors can be operated by performing laminectomy with excision of tumor through posterior approach alone irrespective of location and position of tumor.
6. Use of intraoperative microscope is always associated with excellent outcome.
7. Hence, patients with IDEM tumors can safely be operated even in rural areas and newly developed hospitals like ours, provided you have a good operating microscope.

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# Magnetic Resonance Imaging Study of Age and Sex Variation in the Anatomy of Patellofemoral Articulation

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## Abstract

**Background:** The knee joint is one of the strongest and most complex joints in the human body. The knee is a tricompartmental joint. It is formed by union of the patellofemoral joint (PFJ) and the medial and lateral tibiofemoral joints. PFJ is a complex structure comprising the extensor mechanism of the knee and the femoral trochlea. Females are more prone to recurring dislocations of the PFJ. They are afflicted by isolated PF twice as frequently as males. The anatomical background for this prevalence needs to be studied.

**Aim of Study:** The aim of the study was to study the age and gender variations in various morphometric parameters of the PFJ to the highest possible accuracy using magnetic resonance imaging (MRI) in South Indian Population aged 20–70 years; to provide a baseline data of PFJ morphometric parameters in South India.

**Materials and Methods:** The parameters studied in the study were knee joint MRI obtained from the records of Department of Radiology with the following settings: (1) All studies were performed with a Signa 1.5 T MRI System (GE, Milwaukee, WI, USA). (2) At the time of imaging, every patient was made to lay supine with the knee joint straightened and neutrally rotated. (3) T2-weighted sagittal and axial images of knee joint were studied. (4) The slice thickness for all the sequences was 4 mm. The PF anatomy and congruence were assessed using a total of 22 parameters.

**Observations and Results:** Out of the 140 knee MRI records, 70 (50%) were males, and 70 (50%) were females. Among the 70 males MRI records, 31 (44.3%) were of the right knee and 39 (55.7%) of the left knee. Of the 70 female Knee MRI, 39 (55.7%) were of the right and 31 (44.3%) of the left knee. The mean value reveals statistically significant difference ( $P \leq 0.05$ , Student's unpaired *t*-test) across gender for 18 out of the 22 parameters denoting sex variation in the PFJ among the South Indian population.

**Conclusions:** From our present MRI study in 70 males and 70 females representing the South Indian population, it was concluded that 18 out of the 22 morphometric parameters of the PFJ depicted significant gender variation ( $P \leq 0.05$ , Student's unpaired *t*-test). 16 parameters were found to be statistically highly significant with a *P* value below 0.001.

**Key words:** Arthrosis, Knee joint, Magnetic resonance imaging scan, Morphometry, Patellofemoral joint

## INTRODUCTION

The anatomic morphology and the congruence of the patella and femoral trochlea are the biomechanical basis

for knee flexion and extension.<sup>[1]</sup> Although patellofemoral joint (PFJ) disorders are difficult to characterize and define, clinical data reveal three main categories of PFJ disorders - PF pain, PF instability, and isolated PF arthritis.<sup>[2]</sup> Patients with PF pain, more commonly known as anterior knee pain, feel discomfort when involved in activities such as kneeling, squatting, sitting for extended periods with a bent knee, or going up and down the stairs.<sup>[2,3]</sup> The reason behind such a PF pain, which is common among athletes as well as in sedentary individuals, is less understood.<sup>[2]</sup> The term, "Chondromalacia patellae," or

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softening of the cartilage, was used to indicate this pain. Recent studies have, however, attributed PF morphology and static or dynamic malalignment as an important cause of this anterior knee pain.<sup>[4]</sup> PFJ reveals numerous naturally occurring variations in the morphometry of the patella, femoral trochlea and the congruence between them. In addition to its cartilaginous layer, these alterations are thought to involve the osseous constraints of the patella and the femoral trochlea.<sup>[1]</sup> Developmental or acquired variations in the anatomy and congruence of the PFJ may cause disproportionate distribution of PFJ stress which predispose patients to develop PF pain.<sup>[5,6]</sup> The most important factors predisposing to patellar instability include trochlear dysplasia and patella Alta (high position of the patella). Characterization and quantification of these anatomic anomalies will reveal the individual mechanism of patellar instability and help the orthopedic surgeon choose the optimal treatment. PF dislocations are traumatic derangement to patellar tracking. The literature suggests that certain dysplastic features that are risk factors for patellar instability occur more commonly in females.<sup>[2]</sup> Although a gender disparity among 1<sup>st</sup> time PF dislocations is debatable, females are more prone to recurring dislocations of the PFJ.<sup>[7]</sup> This suggests a need to investigate the factors which favor recurrent dislocations in females. Understanding the PFJ morphology is the key. Osteoarthritis (OA) contributes to a major public health problem. By the year 2020, OA is expected to represent the fourth leading cause of disability.<sup>[8]</sup> OA is well known to afflict the knee joint.<sup>[9]</sup> Recent reports have emphasized the importance of PF-OA as a new entity.<sup>[10-12]</sup> Disproportionate mechanical forces produced by anterior malalignment of the knee joint, also known as PF malalignment may induce excessive stress on the articular surfaces of the PFJ predisposing to osteoarthritic changes.<sup>[13]</sup> Chronic joint injuries, weight, increasing age or overuse of the joint can also lead to PF arthritis. Studies have observed females to be afflicted by isolated PF twice as frequently as males.<sup>[10]</sup> Therefore, there is a need to look for any age and gender-related changes in the anatomy and alignment of PFJ. This can help in suggesting exercises or changes in posture of the knee that can alter the alignment of PFJ and thus decrease anterior knee pain. Very few studies have concentrated on these anatomic variations among the Indian population. This study is an attempt on our behalf to highlight the variations in anatomy and congruence of PFJ. Plain radiographic and computed tomographic studies allow descriptions or measurements of the bony PFJ. Many of such previous radiographic studies have not contemplated the articular cartilage surfaces. Unlike conventional radiographs, transverse magnetic resonance images (MRI) allow complete and clear visualization of the entire PFJ by clearly delineating the proximal portion of the femoral trochlea. MRI is recognized as a standard

procedure and has replaced diagnostic arthroscopy as the primary diagnostic modality. Moreover, MRI can be used to assess anatomic variants that may contribute to chronic patellar instability and other forms of PFJ disorders.<sup>[14-18]</sup> We, therefore, tried to analyze the anatomy and congruence of the PFJ using MRI. PF pain secondary to arthrosis can be managed with a variety of operative and non-operative modalities. Patellofemoral arthroplasty (PFA) is one of the latest treatment options targeting the pain caused by severe, isolated OA of the PFJ. At present, PFA remains a contentious treatment for advanced PF-OA due to its variable outcomes. Total knee replacement rather than PFA is preferred by many surgeons for isolated advanced PF-OA, to gain more consistent outcomes.<sup>[19]</sup> One of the correctable issues is to formulate appropriate design and dimension of the prosthesis best suited for the South Indian population in particular. Gender and age variability in the dimensions of distal femur and patella may have implications for implant design and functional outcome after PFA. Hence, this study also hopes to address the unmet clinical need for PF implants that more accurately addresses the morphometric differences between male and female femur, patella and the congruence between them.

### **Aim and Objectives**

Our study is undertaken with the following aim and objectives.

#### ***Aim of the study***

The aim of the study was to study the age and gender variations in various morphometric parameters of the PFJ to the highest possible accuracy using MRI in South Indian population aged 20–70 years during the period from October 2013 to October 2015 and to provide a baseline data of PFJ morphometric parameters in South India.

#### ***Objectives***

1. To study the various structures forming the knee joint using MRI scans of knee joint taken from adult live subjects.
2. To assess the PF anatomy and congruence using the patellar parameters, femoral trochlear parameters and PF congruence parameters.
3. To describe the age and gender variations between PF anatomy and congruence in adults.
4. To compare the results of this study with that of other similar published works available in literature.

### **Study Period**

The study period was from October 2013 to October 2015.

### **Institute of Study**

This study was conducted at Kasturba Medical College, Mangalore, Karnataka, India.

## MATERIALS AND METHODS

The materials required for the present study consists of: 140 MRI scan records of the knee joint of subjects, confirming to the inclusion and exclusion criteria, collected from the Department of Radiology, Kannur Medical College, Anjarakandy, Kannur, after obtaining the Institute Ethics Committee clearance.

### Study Design

The study design was a retrospective study.

### Study Sample Size

A total of 140 knee joint MRI records of patients (70 males and 70 females).

### Study Sample Size Calculation

By the purposive sampling method, with 95% confidence level and 90% power, the sample size of 140 subjects was calculated by the formula given below:

$$\text{Sample size (n)} = \frac{2 \times (Z_{\alpha} + Z_{\beta})^2 \times \sigma^2}{\delta^2} = 70$$

(approximate value)

$Z_{\alpha}$  = Level of significance (95%) = 1.96

$Z_{\beta}$  = Required power (90%) = 1.282

$\sigma$  = Anticipated standard deviation of the parameter=1.95

$\delta$  = Test value of the difference between means =1.06

Total trial size =  $2 \times n = 2 \times 70$  (approximate) = 140

### Inclusion Criteria

Randomly selected knee joint MRI records of patients of known sex and age from 20 to 70 years, who had taken it for various reasons in the Radiology Department were included in the study.

### Exclusion Criteria

Patients with a history of congenital abnormality, severe trauma, surgery, acute patellar dislocation, knee joint tumor, and rheumatic arthritis were excluded from the study.

### Materials Used

The parameters studied in the study were knee joint MRI obtained from the records of Department of Radiology with the following settings: (1) All studies were performed with a Signa 1.5 T MRI System (GE, Milwaukee, WI, USA). (2) At the time of imaging, every patient was made to lay supine with the knee joint straightened and neutrally rotated. (3) T2-weighted sagittal and axial images of knee joint were studied. (4) The slice

thickness for all the sequences was 4 mm. The PF anatomy and congruence were assessed using a total of 22 parameters. When the chondral surface was involved during the measurement of any parameter, the contour of the chondral surface was measured as a reference instead of the subchondral bone.<sup>[20]</sup>

To assess patellar anatomic morphology, the following parameters were studied on the patellar mid transverse layer of the axial MRIs, where the patellar maximal transverse diameter was visible.<sup>[20]</sup>

1. Patella angle (PA): Angle between the medial and lateral facets of patella with the point of the patellar central ridge as the zenith [Figures 1 and 2].
2. Patella width (PW): Distance between most medial and most lateral points of the patella [Figures 1 and 2].
3. Patella thickness (PT): Distance between the points of the patellar central ridge to the patellar anterior point [Figures 1 and 2].
4. Patella lateral facet width (PLFW): Distance between the most lateral point of the patella and the patella central point [Figures 1 and 2].
5. Patella facet thickness (PFT): Distance between patellar central point and the point of patellar central ridge [Figures 1 and 3].
6. Patella lateral facet ratio (PLFR=PLFW/PW): Patella lateral facet width:patella width.
7. Patella relative thickness (PRT=PT/PW): Patella thickness:patella width.
8. Patella facet thickness ratio (PFTTR=PFT/PT): Patella facet thickness:patella thickness.

To assess femoral trochlear anatomic morphology, the following parameters were studied, measured on the initial layer of the axial MRIs.

1. Sulcus angle (SA): Angle between the medial and lateral facets of the femoral trochlea with the deepest trochlear point as the zenith [Figures 4 and 5].
2. Sulcus width (SW): Distance between the most medial and most lateral points of the femoral trochlea [Figures 4 and 5].
3. Sulcus depth (SD): Distance between the deepest trochlear point to line SW (the sulcus central point is defined as the point of intersection of the perpendicular line and line SW) [Figures 4 and 6].
4. Sulcus lateral facet width (SLFW): Distance between the most lateral point of the trochlea and the sulcus central point [Figures 4 and 6].
5. Trochlea epicondylar axis angle (TEAA): Angle between the line SW and the line of the femoral epicondylar axis [Figures 4 and 7].
6. Sulcus lateral facet ratio (SLFR=SLFW/SW): Sulcus lateral facet width:sulcus width.



7. Sulcus relative depth (SRD= $SD/SW$ ): Sulcus depth:sulcus width.

To assess PF congruence, the following parameters were measured on the initial layer of the axial MRIs, where the femoral epicondylar axis was clearly visible from the proximal to the distal portions of the PFJ.

1. Lateral patella displacement (LPD): Distance between the 2 perpendicular lines drawn to line SW from the most medial point of patella (line a) and from the most medial point of femoral trochlea (line b) [Figures 8 and 9].
2. Lateral trochlear inclination (LTI): Angle between lateral trochlear facet and the line connecting the posterior-most surface of femoral condyle [Figures 9 and 10].
3. Patella epicondylar axis angle (PEAA): Angle between the line connecting the most lateral and medial points of the patella and the line of femoral epicondylar axis [Figures 9-11].

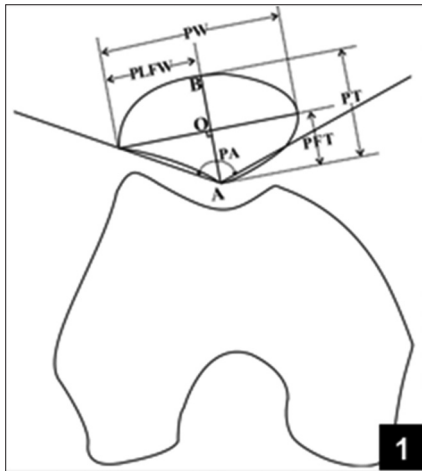


Figure 1: Parameters used to assess patellar anatomy on axial magnetic resonance images

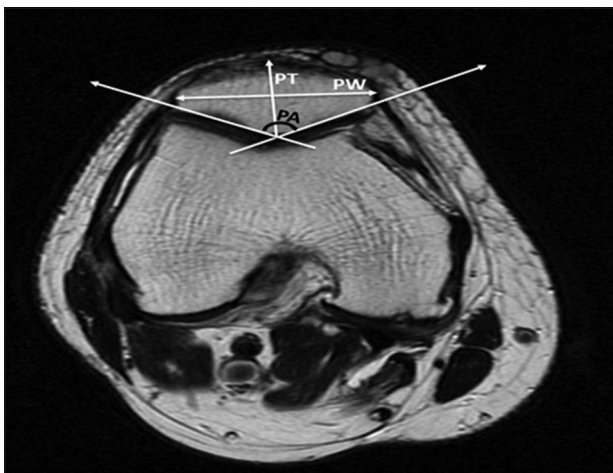


Figure 2: Magnetic resonance imaging right knee - T2 axial section illustrating landmarks for measuring patella angle (PA), patella width (PW) and patella thickness (PT)

4. Width congruence (WC):  $PW:SW$
5. Depth congruence (DC):  $SD:PFT$
6. Congruence angle (CA): Angle between the line connecting the point of patellar central ridge and the sulcus central point (line a) and the line bisecting the SA (line b), [Figures 11-13].

One parameter of PF congruence was measured on the sagittal images where the patellar maximal length is visible.

7. Insall-Salvati index (ISI): Ratio of patella tendon length to the patella length (PTL/PL) [Figure 14].

### Statistical Analysis

The general descriptive statistics were done for all the measurements providing means and standard deviations (SD) separately for both male and female. Student's unpaired *t*-test was used to check whether significant

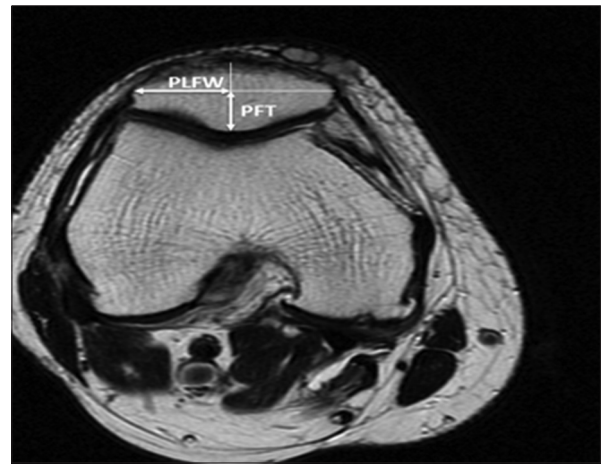


Figure 3: Magnetic resonance imaging right knee - T2 Axial section illustrating landmarks for measuring patella lateral facet width (PLFW) and patella facet thickness (PFT)

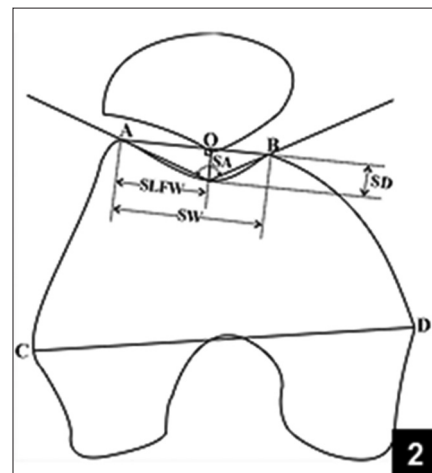


Figure 4: Diagram of parameters used to assess the femoral trochlear anatomy on the axial magnetic resonance images

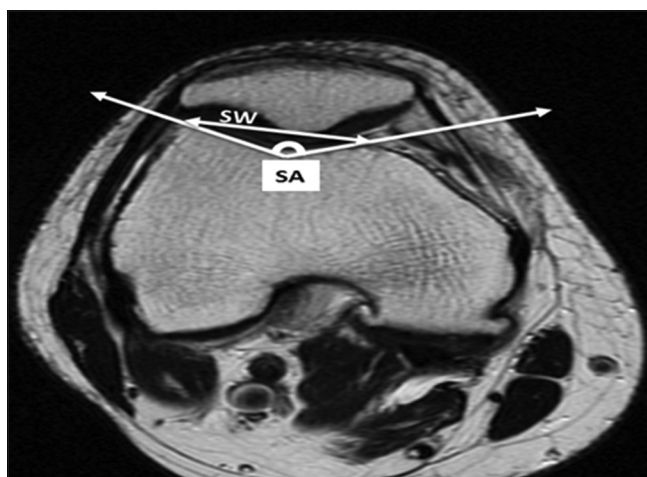


Figure 5: Magnetic resonance imaging right knee - T2 axial section illustrating landmarks for measuring sulcus angle (SA) and sulcus width (SW)

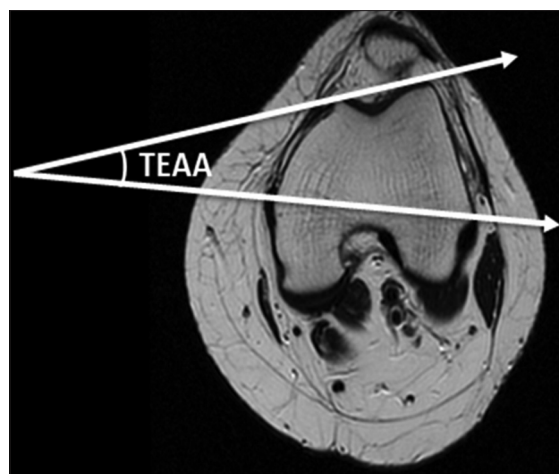


Figure 7: Magnetic resonance imaging left knee - T2 axial section illustrating landmarks for measuring TEAA

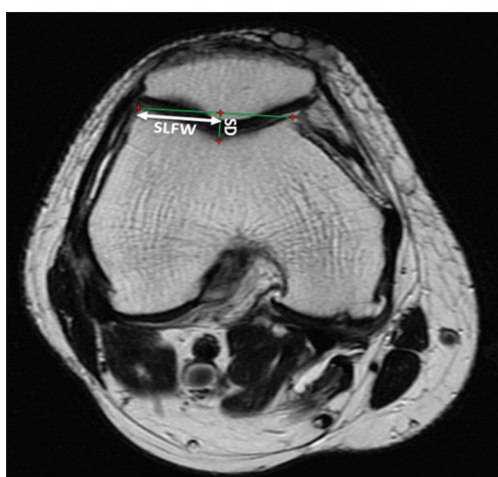


Figure 6: Magnetic resonance imaging right knee - T2 axial section illustrating landmarks for measuring sulcus depth (SD) and sulcus lateral facet width (SLFW)

differences exist ( $P \leq 0.05$ ) between each male and female, mean measurements. ANOVA test was used to check significant differences ( $P \leq 0.05$ ) between the mean measurements of the 4 age groups.

## OBSERVATIONS

140 knee MRI records of patients collected from the Department of Radiology Kasturba Medical College, Mangalore, Karnataka, conforming to the inclusion and exclusion criteria from October 2013 to October 2015 were included in this retrospective study.

### Gender Variation

Out of the 140 knee MRI records, 70 (50%) were males and 70 (50%) were females. Among the 70 males MRI records,

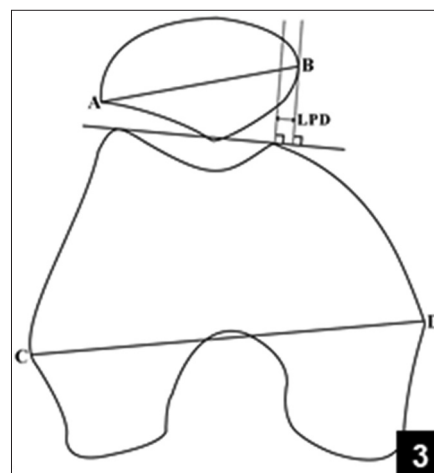


Figure 8: Diagram of parameter to assess patellofemoral congruence

31 (44.3%) were of the right knee and 39 (55.7%) of the left knee. Of the 70 female Knee MRI, 39 (55.7%) were of right and 31 (44.3%) of the left knee. The mean value reveals statistically significant difference ( $P \leq 0.05$ , Student's unpaired t-test) across gender for 18 out of the 22 parameters denoting sex variation in the PFJ among the South Indian population as shown in Tables 1-3. Among the patellar parameters, the PA, PW, PT, PLFW, PFT, PRT, and PFT ratio exhibited statistically highly significant sexual dimorphism ( $P \leq 0.001$ ). The only patellar parameter which was not significant statically was the PLFR. The mean value was higher in males than females except for PLFR (PLFW/PW) and PFT ratio (PFT/PT) as shown in Table 1. The comparison of SD suggests that males exhibit more variability than females in all measurements of patella except PT, PFT, PRT (PT/PW), and PFT ratio (PFT/PT) as shown in Table 1.

Analysis of trochlear parameters reveals a higher mean value in males than females except for trochlear epicondylar

**Table 1: Means, standard deviations and “P” values of patellar parameters by sex in south indian population**

Parameters	Mean		SD		P value (Student's t-test)
	Male	Female	Male	Female	
Patella angle	127.23	125.01	4.76	2.87	0.001*
Patella width	42.21	36.07	2.03	1.49	0.000*
Patella thickness	20.30	16.24	0.89	0.92	0.000*
Patella lateral facet width	22.59	19.47	1.99	1.11	0.000*
Patella facet thickness	12.21	10.26	0.77	0.99	0.000*
Patella lateral facet ratio	0.5358	0.5406	0.0495	0.0370	0.520
Patella relative thickness	0.4817	0.4513	0.0265	0.0367	0.000*
Patella facet thickness ratio	0.6024	0.6319	0.0454	0.0528	0.001*

\*Highly significant. \*\*Significant. SD: Standard deviation

**Table 2: Means, SD and “P” values of trochlear parameters by sex in south indian population**

Parameters	Mean		SD		P value (Student's t-test)
	Male	Female	Male	Female	
Sulcus angle	134.32	130.11	6.57	4.47	0.000*
Sulcus width	38.16	32.12	3.06	1.22	0.000*
Sulcus depth	8.41	7.57	1.27	0.94	0.000*
Sulcus lateral facet width	23.63	18.55	1.90	1.78	0.000*
Trochlea epicondylar axis angle	12.26	12.46	3.24	1.02	0.610
Sulcus lateral facet ratio	0.6204	0.5774	0.0390	0.0510	0.000*
Sulcus relative depth	0.2199	0.2356	0.0255	0.0273	0.001*

\*Highly significant. \*\*Significant. SD: Standard deviation

**Table 3: Means, SD and “P” values of patellofemoral congruence parameters by sex in South indian population**

Parameters	Mean		SD		P value (Student's t-test)
	Male	Female	Male	Female	
LTI	16.68	15.88	4.59	5.27	0.341
LPD	3.37	1.49	4.64	4.51	0.016**
PEAA	8.35	10.79	2.30	3.34	0.000*
Congruence angle	11.66	14.66	9.30	3.20	0.012**
Insall-Salvati index	1.12	1.25	0.098	0.116	0.000*
Width congruence	1.11	1.12	0.086	0.070	0.313
Depth congruence	0.6894	0.7390	0.0981	0.0707	0.001*

\*Highly significant. \*\*Significant. SD: Standard deviation, LPD: Lateral patella displacement, LTI: Lateral trochlear inclination, PEAA: Patella epicondylar axis angle

**Table 4: Number of persons in each age group**

Age (in years)	Total number of persons (%)
21–30	37 (26.4)
31–40	35 (25)
41–50	30 (21.4)
>50	38 (27.1)
Total	140 (100)

axis angle and SRD as shown in Table 2. Here the comparison of SD suggests that males exhibit a more variability than females in all the trochlear parameters except SLFR (SLFW/SW) and SRD (SD/SW) as shown in Table 2. Among the trochlear parameters analyzed in the South Indian population, the SA, SW, SD, SLFW, SRD, and SLFR were found to be statistically highly significant ( $P \leq 0.001$ ) depicting gender variation.

For the PF congruence, the mean value was higher in females than males except for LTI and LPD as seen in Table 3. The comparison of SD among the PF congruence parameters reveals a more variability in males than females in all the parameters except LTI, PEAA, and ISI (PTL/PL) as seen in Table 3. Among the PF congruence parameters analyzed in the South Indian population LPD, PEAA, DC, ISI, and CA were found to be statistically significant ( $P \leq 0.05$ ) depicting gender variation.

### Age Variation

The total of 140 knee MRI records were categorized into four different age groups, 21–30, 31–40, 41–50, and >50 years with 37 (26.4%), 35 (25%), 30 (21.4%), and 38 (27.1%) persons, respectively, in each age group, as shown in Table 4.

On the evaluation of the mean value of various morphometric parameters of the PFJ, statistically significant difference ( $P \leq 0.05$ , ANOVA test) across the four age groups was observed for most of the parameters in the knee MRI records as shown in Tables 5-7. Among the patellar parameters, age difference in ANOVA was found in PA, PW, PFT ratio ( $P < 0.001$ ), and PLFR ( $P \leq 0.05$ ), but not for PT, PLFW, PFT, and PRT as shown in Table 5.

On analysis of the trochlear parameters, highly significant age difference in ANOVA was observed in SA, SD, SRD, and SLFR ( $P < 0.001$ ), but not in SW, SLFW, and TEAA as shown in Table 6.

The PF congruence parameters showed significant age difference in ANOVA for LTI, Lateral Patellar Displacement, ISI, DC, WC ( $P \leq 0.001$ ), and PEAA ( $P \leq 0.05$ ), but not for CA as shown in Table 7.

On analysis of the patellar parameters, Karl Pearson correlation revealed a positive correlation of PW with age. The PA, PLFR, and PFT ratio were found to be decreasing with age. Rest of the patellar parameters did not show any significant variation trend with age as depicted in Table 8.

The SA and SLFR were found to be decreasing with increase in age. Rest of the trochlear parameters did not show any significant variation trend with age as depicted in Table 9.

The lateral patellar displacement was found to be decreasing with age. Rest of the congruence parameters did not show any significant variation trend with age as depicted in Table 10.

## DISCUSSION

Disorders of the PFJ are one of the most important factors contributing to anterior knee pain which presents as a very common problem in orthopedics and sports medicine. The PFJ and its morphometry to PF pain and PF OA have been related by radiological studies previously.<sup>[5,13,21,20]</sup> Data on gender or age comparative anatomical analysis of the measurements of the PFJ are limited. Our investigation has identified several significant PF anatomic variations with respect to age and gender among the South Indian population which may account for age and gender-wise prevalence of certain PF disorders. Recently, PFA has attracted increased interest as a salvage treatment for isolated PF arthritis.<sup>[22]</sup> There is a significant difference in the morphology of the PFJ between the Asian and Western patients.<sup>[23]</sup> There is a lack of morphometric data about the Asian and particularly the Indian PFJ which could be responsible for poor clinical results following arthroplasty.<sup>[24]</sup> The radiographic studies provide an added advantage of having digital data for future reference and research. In this study, we adopted the indirect method by MRI, and all the measurements in this study were collected non-invasively.

**Table 5: Means, SD and “P” values of patellar parameters by age in South Indian population**

Parameters	Age group (Mean±SD)				P value
	21–30	31–40	41–50	>50	
PA	125.31±3.47	128.74±5.16	126.79±2.74	123.96±2.80	0.000*
PW	38.76±2.69	39.84±2.82	37.25±3.68	40.36±4.18	0.002*
PT	18.09±2.43	18.35±2.18	17.79±1.78	18.74±2.37	0.342
PLFW	20.99±2.32	21.63±2.78	20.51±1.52	20.92±2.03	0.235
PFT	11.05±1.35	11.36±1.34	11.54±1.52	11.04±1.06	0.335
PLFR	0.54±0.05	0.542±0.05	0.55±0.04	0.52±0.04	0.014**
PRT	0.47±0.05	0.46±0.03	0.48±0.02	0.46±0.03	0.185
PFTR	0.61±0.05	0.62±0.03	0.65±0.07	0.59±0.04	0.000*

\*Highly significant. \*\*Significant. SD: Standard deviation, PA: Patella angle, PW: Patella width, PT: Patella thickness, PLFW: Patella lateral facet width, PFT: Patella facet thickness, PLFR: Patella lateral facet ratio, PRT: Patella relative thickness, PFTR: Patella facet thickness ratio

**Table 6: Means, SD and “P” values of trochlear parameters by age in South Indian population**

Parameter	Age group (Mean±SD)				P value
	21–30	31–40	41–50	>50	
SA	136.79±5.46	134.25±4.62	129.54±2.60	128.01±5.64	0.000*
SW	34.19±3.03	36.31±5.04	35.26±2.89	34.91±3.69	0.124
SD	7.15±0.90	8.11±1.50	8.26±0.65	8.47±1.04	0.000*
SLFW	21.50±2.60	21.81±3.69	20.72±2.26	20.31±3.55	0.157
TEAA	12.63±2.97	12.57±3.20	12.64±0.69	11.67±1.57	0.232
SLFR	0.63±0.04	0.60±0.031	0.59±0.04	0.58±0.07	0.000*
SRD	0.21±0.02	0.22±0.024	0.24±0.02	0.24±0.03	0.000*

\*Highly significant. \*\*Significant. SD: Standard deviation, SA: Sulcus angle, SW: Sulcus width, SD: Sulcus depth, SLFW: Sulcus lateral facet width, TEAA: Trochlea epicondylar axis angle, SLFR: Sulcus lateral facet ratio



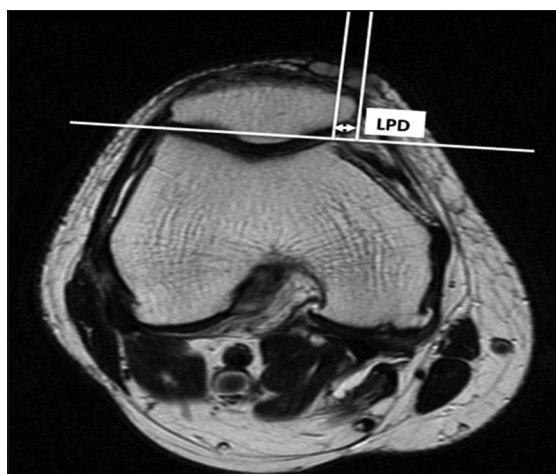


Figure 9: Magnetic resonance imaging right knee - T2 axial section illustrating landmarks for measuring lateral patella displacement (LPD)

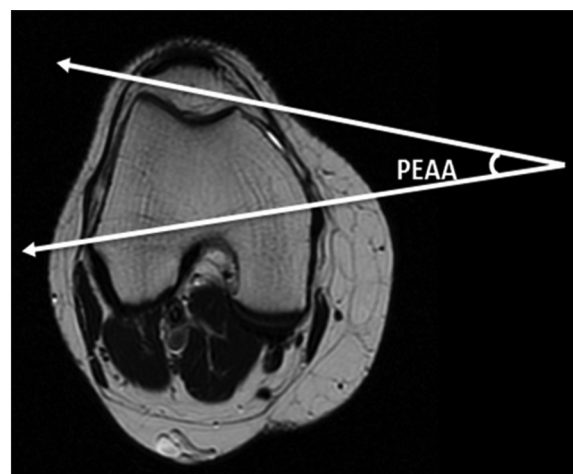


Figure 11: Magnetic resonance imaging right knee: T2 axial section illustrating landmarks for measuring patella epicondylar axis angle (PEAA)

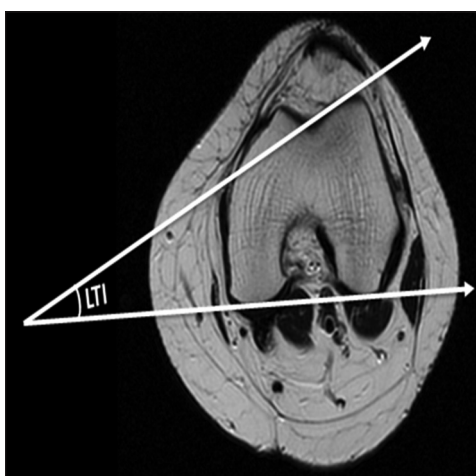


Figure 10: Magnetic resonance imaging left knee - T2 axial section illustrating landmarks for measurement of lateral trochlear inclination (LTI)

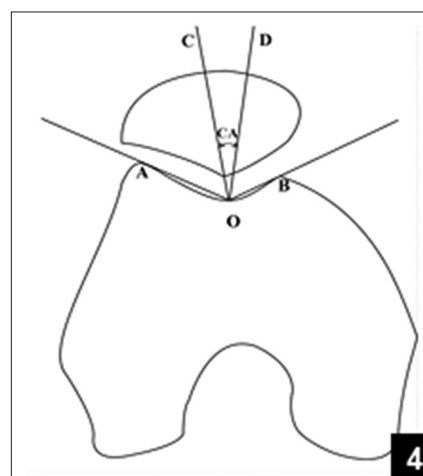


Figure 12: Diagram of congruence angle, indicated as COD

### Sex Variation

From our present study of the PFJ in the South Indian Population, 18 out of the 22 parameters were found to be statistically significant, denoting sex variation in the PFJ ( $P \leq 0.05$ ).

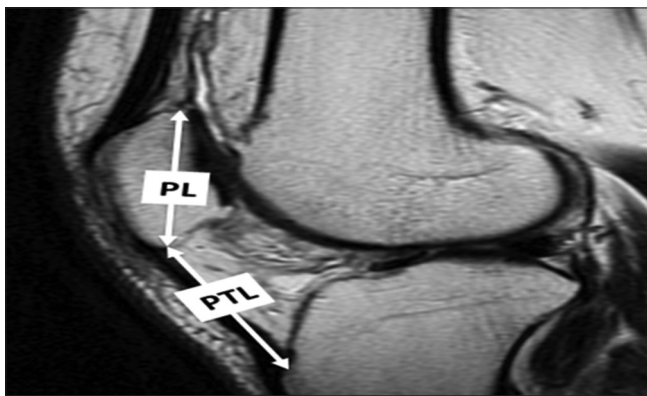
### Patellar Parameters

The patella serves as a marker for the alignment of the extensor mechanism of the knee joint. Skeletal components play a pivotal role in the determination of sex in forensic and anthropological fields, and the bony patella has been used in many studies as a sex assessor with the highest rate of classification of 95% thereby making the patella useful for sex determination.<sup>[25,26]</sup> In our analysis of the patellar parameters from MR images, the PA, PW, PT, PLFW, PFT, PRT, and PFT ratio exhibited statistically highly significant sexual dimorphism ( $P \leq 0.001$ ). The only patellar parameter which was not significant statically

was the PLFR. It was observed that the male patellae had larger geometrical dimension than female patellae. Similar findings were observed by Yoo *et al.* in the Korean population and Baldwin *et al.* in the western population.<sup>[26,27]</sup> In our study, mean value was higher in males than females for all the patellar parameters, except for PLFR (PLFW/PW) and PFT ratio (PFT/PT). The mean PA was found to be  $127.23^\circ \pm \text{SD } 4.76^\circ$  in males and  $125.01^\circ \pm \text{SD } 2.87^\circ$  in females. It was reported that the patella of Asian population is thinner and smaller than Western subjects.<sup>[28,29]</sup> This fact is confirmed in this study on the South Indian population. Our study showed the mean PW to be 42.21 mm in males and 36.07 mm in females which was smaller than reported by Baldwin *et al.*,<sup>[27]</sup> Shang *et al.*,<sup>[29]</sup> and Yoo *et al.*<sup>[26]</sup> for Westerns, southern Chinese, and Korean population. On analysis of the mean PT, it was found to be smaller than that of the Western, Korean, and southern Chinese population.<sup>[31,32]</sup> In our study, the PT was  $20.30 \pm 0.89$  mm for males and  $16.24 \pm 0.92$  mm for females. Thus, the



**Figure 13: Magnetic resonance imaging right knee - T2 axial section illustrating landmarks for measuring congruence angle (CA)**



**Figure 14: Magnetic resonance imaging knee - T2 sagittal image illustrating landmarks for measuring Insall-Salvati index = Patella tendon length (PTL)/Patella length (PT)**

South Indian female is found to have the thinnest patella of mean value 16.24 mm among the western, Korean, and South Chinese population. A comparison of PW and PT in different population groups is shown in Table 11.

We measured the PRT which is the ratio of PT to PW. This can also be used as a useful guide for estimating premenstrual patellar thickness. The PRT was found to be 0.4817 and 0.4513 mm, respectively, in males and females of the South Indian Population with a statistically high significance ( $P = 0.000$ ). PFT was 12.21 mm in males and 10.26 mm in females with a statistically high significance ( $P = 0.000$ ). PLFW which revealed a mean value of 22.59 mm in males and 19.47 mm in females was smaller compared to the south Chinese population, 26.91 mm in males and 23.30 mm in females, while the same dimension measured in western was 29.7 mm in males and 25.3 mm in females. Yang *et al.* observed that PF cartilage lesions are more likely in those cases where a patella is dominated by a lateral articular facet.<sup>[20]</sup> This can be calculated with

**Table 7: Means, SD and “P” values of patellofemoral congruence parameters by age in South Indian population**

Parameter	Age group (Mean±SD)				P value
	21–30	31–40	41–50	>50	
LTI	16.94±5.96	16.63±2.19	12.85±4.61	17.86±4.87	0.000*
LPD	5.25±2.14	4.60±2.00	1.65±4.49	-1.70±5.21	0.000*
PEAA	9.74±3.62	10.20±3.75	8.16±2.65	9.94±1.71	0.039**
CA	13.14±2.87	12.17±2.28	15.74±2.78	12.07±12.75	0.135
ISI	1.17±0.112	1.22±0.093	1.24±0.166	1.13±0.11	0.001*
WC	1.14±0.04	1.11±0.09	1.06±0.06	1.16±0.09	0.000*
DC	0.65±0.09	0.71±0.07	0.72±0.06	0.77±0.09	0.000*

\*Highly significant. \*\*Significant. SD: Standard deviation, LTI: Lateral trochlear inclination, LPD: Lateral patella displacement, PEAA: Patella epicondylar axis angle, CA: Congruence angle, WC: Width congruence, DC: Depth congruence, ISI: Insall-Salvati index

**Table 8: Correlation between the patellar parameters and age**

Parameter		Karl Pearson correlation	P value
Age	Patella angle	-0.209*	0.013
	Patella width	0.195*	0.021
	Patella thickness	0.149	0.079
	Patella lateral facet width	0.016	0.852
	Patella facet thickness	0.014	0.865
	Patella lateral facet ratio	-0.168*	0.047
	Patella relative thickness	0.019	0.822
	Patella facet thickness ratio	-0.183*	0.031

\*Significant P value  $\leq 0.05$ . \*\*Highly significant parameters P  $\leq 0.001$

the PLFR which was found to be 0.5358 in males and 0.5406 in females. PFT ratio which is the ratio of PFT to PT was 0.6024 in males and 0.6319 in females with highly significant P value of 0.001.

### Trochlear Parameters

The mechanics and pathomechanics of the PF articulation are largely dependent on the configuration and location of the intercondylar groove on the distal end of femur.<sup>[33,34]</sup> The relation between the location and orientation of the femoral sulcus, the deepest depression of the intercondylar groove to the condyles or the anatomic and mechanical axes of the femur were defined by Walmsley.<sup>[34]</sup> Patellar tracking during knee flexion is provided by the femoral trochlea, which consists of the lateral and medial facets of the femoral. Among the trochlear parameters analyzed in the South Indian population, the SA, SW, SD, SLFW, SRD, and SLFR were found to be statistically highly significant ( $P \leq 0.001$ ) depicting gender variation. The mean SA in our study was found to be 134.32° in males and 130.11° in females. Our values were found to be lower than those according to Brattstroem<sup>[21]</sup> (142°) and Merchant<sup>[34]</sup> (138°). Murshed *et al.*<sup>[35]</sup> reported the mean SA in males and in females to be 134° ± SD 5.1° and 133.2° ± SD 6.7°, respectively, in the Turkish population. The mean

**Table 9: Correlation between the trochlear parameters and age**

Parameter		Karl Pearson correlation	P value
Age	Sulcus angle	-0.546**	0.000
	Sulcus width	0.056	0.514
	Sulcus depth	0.360**	0.000
	Sulcus lateral facet width	-0.100	0.241
	Trochlea epicondylar axis angle	-0.162	0.055
	Sulcus lateral facet ratio	-0.260**	0.002
	Sulcus relative depth	0.402**	0.000

\*Significant P value  $\leq 0.05$ . \*\*Highly significant parameters  $P \leq 0.001$

**Table 10: Correlation between the patellofemoral congruence parameters and age**

Parameter		Karl Pearson correlation	P value
Age	LTI	-0.010	0.909
	LPD	-0.564**	0.000
	PEAA	-0.016	0.853
	Congruence angle	-0.025	0.770
	Insall-Salvati index=PTL/PL	-0.116	0.170
	Width congruence	0.152	0.072
	Depth congruence	0.412**	0.000

\*Significant P value  $\leq 0.05$ . \*\*Highly significant parameters  $P \leq 0.001$ . LTI: Lateral trochlear inclination, LPD: Lateral patella displacement, PEAA: Patella epicondylar axis angle, PTL: Patella tendon length, PL: Patella length

**Table 11: Comparison of patella width and patella thickness**

Population	Patella width		Patella thickness	
	Male	Female	Male	Female
Present study (South Indians)	42.21	36.07	20.30	16.24
Baldwin <i>et al.</i> (Western)	50.3	43.5	23.9	21.8
Yoo <i>et al.</i> (Koreans)	47.01	41.25	23.1	21.2
Shang <i>et al.</i> (South Chinese)	47.01	41.25	23.91	21.52

SD was found to be higher in males ( $8.41 \pm 1.27$  mm) than females ( $7.57 \pm 0.94$  mm) and is statistically significant ( $P < 0.001$ ). SA and SD together can be used as a reliable tool to assess trochlear dysplasia. In our study, males had a shallower femoral groove compared to the females, which makes them more prone to patellar instability and can be an important factor causing anterior knee pain in those men involved in sports. The mean SW was found to be  $38.16 \pm 3.06$  mm in males and  $32.12 \pm 1.22$  mm in females. The SLFW being  $23.63 \pm 1.90$  mm in males and  $18.55 \pm 1.78$  mm in females. According to Poilvache *et al.* and Stoeckl *et al.*,<sup>[36,37]</sup> the TEAA is a reproducible reference for knee flexion and extension, making it an anatomical marker that indicates femoral condyles. In our study, TEAA was  $12.26^\circ$  for males and  $12.46^\circ$  for females showing no statistically significant difference between the TEAA values for males and females. All these values of femoral trochlea should be taken into consideration to

tailor appropriate prosthesis for femoral component of TKA or PFA.

### Congruence Parameters

Gross malalignment syndromes of the PFJ and dislocations of the patella are easily diagnosed, but more subtle malalignment and patellar tracking disorders often escape detection. The CA was described by Merchant *et al.* and used by many others as a tool to identify subtle malalignment of the PFJ.<sup>[33]</sup> In our study, the mean CA was found to be  $11.66^\circ \pm SD9.30^\circ$  in males and  $14.66^\circ \pm SD3.20^\circ$  in females. Our study revealed a more positive value of the CA compared to those of Merchant *et al.*,<sup>[34]</sup> which may be attributed to the difference in the degree of flexion of the knee while recording the measurement. In our study, we found a lower SA and higher CA in female compared to the males. This factor makes the South Indian females more prone to anterior knee pain due to increased load on the PFJ. In our study, the LPD was found to be  $3.37 \pm 4.64$  mm in males and  $1.49 \pm 4.51$  mm in females. The positive value indicates a lateralized position of patella. A laterally positioned patella (defined as  $LPD > 5$  mm) is associated with a high specificity for maltracking. Yang *et al.* found that LPD increases the risk for PF cartilage lesions.<sup>[20]</sup> It is thought that the distribution of stress in the PFJ changes as a result of patella displacement. In addition to the CA and LPD, we used the PEAA to assess PF congruence in the transactional images. The femoral epicondylar axis, in contrast, has been identified as the rotational axis of flexion and extension of the knee by Poilvache *et al.* and Stoeckl *et al.*<sup>[37,38]</sup> In our study, the PEAA was found to be  $8.35^\circ \pm SD2.30^\circ$  in males and  $10.79^\circ \pm SD 3.34^\circ$  in females. This is in accordance with the values observed by Yang *et al.*<sup>[36]</sup> In our study, it showed LTI to be  $16.68^\circ \pm SD 4.59^\circ$  in males and  $15.88^\circ \pm SD 5.27^\circ$  in females. This is in accordance with the values observed by Carrillon *et al.* in normal subjects of France ( $16.93^\circ \pm SD 4.97^\circ$ ).<sup>[14]</sup> LTI of men and women in our series did not show a statistically significant difference. Numerous methods exist for determining patellar height on lateral radiographs.<sup>[38-41]</sup> The most widely used method is the patellar tendon: Patella ratio of Insall and Salvati.<sup>[42]</sup> Our analysis of the ISI showed a value of  $1.12 \pm 0.098$  in males and  $1.25 \pm 0.116$  in females, showing a statistically high significance ( $P = 0.000$ ).

### Age Variation

This study also demonstrates differences found in the anatomical profile of the PFJ between age groups. In our study, among the patellar parameters, the significant age difference was found in PA, PW, PFT ratio ( $P < 0.001$ ), and PLFR ( $P \leq 0.05$ ), but not for PT, PLFW, PFT, and PRT. Furthermore, a positive correlation of PW with age was revealed by the Karl Pearson correlation



coefficient in our study. On analysis of the trochlear parameters, the significant age difference was observed in SA, SD, SRD, and SLFR ( $P < 0.001$ ), but not in SW, SLFW, and TEAA. Furthermore, an increase in SD and SRD with age was observed. The SA and SLFR were found to be decreasing with increase in age. Rest of the trochlear parameters did not show any significant variation trend with age. Nietosvaara found the osseous SA to be inversely related to age, being flattest in young children and deepening steadily through growth.<sup>[43]</sup> The PF congruence parameters showed significant age difference for LTI, lateral patellar displacement, ISI, DC, WC ( $P \leq 0.001$ ), and PEAA ( $P \leq 0.05$ ), but not for CA. Furthermore, a strong positive correlation of DC with age was observed. The lateral patellar displacement was found to be decreasing with age. Rest of the congruence parameters did not show any significant variation trend with age.

## SUMMARY AND CONCLUSIONS

From our present MRI study in 70 males and 70 females representing the South Indian population, it was concluded that 18 out of the 22 morphometric parameters of the PFJ depicted significant gender variation ( $P \leq 0.05$ , Student's unpaired t-test). 16 parameters were found to be statistically highly significant with a P value below 0.001. Significant age variation in ANOVA test was found in 14 out of the 22 parameters of the PFJ ( $P \leq 0.05$ ). This pilot study representative of the South Indian population can provide guidelines to manufacture prosthetic inventories suitable for the Indian population having smaller anthropometric measurements than Western population, especially to design gender and age-specific prosthesis.

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# Association between Kidney Disease and Pre-diabetes by Plasma Glucose and HbA1C Levels

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## Abstract

**Introduction:** Chronic kidney disease is recognized as a global health problem. Growing evidence links prediabetes to albuminuria and CKD and this association is a matter of concern worldwide nowadays. The study aims to find the association between kidney disease and prediabetes and compare it with normoglycemic controls.

**Purpose:** To study the association between Kidney disease and Prediabetes.

**Material And Methods:** It is a case control study (100 Prediabetic cases and 50 normoglycemic controls). Both prediabetic men and women >20 years were taken with FBS >100mg/dl but <126mg/dl and/or PPBS >140 mg/dl but <199mg/dl and/or HbA1C 5.7-6.4% as per American Diabetes Association Criteria. CKD was defined by eGFR- 15- 59 per 1.73m<sup>2</sup> and/or albumin creatinine ratio 30-300mg/g (microalbuminuria) and >300 mg/g (macroalbuminuria).

**Result:** Of the total 100 cases and 50 controls 9% cases and none of the controls showed microalbuminuria. 7% cases and none of the controls showed macroalbuminuria (Chi square-8.96, p value- 0.005). 16% cases and none of the controls were under stage 3 and 4 of CKD (Chi square-9.65, p value-0.05). Overall 18% prediabetic cases and no normoglycemic controls showed evidence of kidney disease.

**Conclusion:** Kidney disease prevalence is high among people with prediabetes. Prediabetes can be a target for early intervention by lifestyle changes and control of modifiable risk factors for preventing and/or progression of CKD in these individuals.

**Key words:** Albumin creatinine ratio, Albuminuria, Chronic Kidney Disease, Macroalbuminuria, Microalbuminuria, Prediabetes

## INTRODUCTION

Chronic Kidney disease (CKD) is recognized as a global health problem. It is increasingly prevalent worldwide, in developing and developed countries alike<sup>1</sup> and is associated with substantial burden of morbidity, mortality and health care costs. Concurrently, the incidence of Prediabetes, defined as impaired fasting glucose (IFG) or impaired glucose tolerance (IGT), has reached epidemic proportions worldwide. Growing evidence links prediabetes to

albuminuria and CKD and this association is a matter of concern worldwide nowadays.

### Pre-Diabetes

- Prediabetes is a precursor stage to Diabetes Mellitus<sup>2</sup> in which not all symptoms required to label a person as diabetes are present, but blood sugar is abnormally high. This stage is often referred to as "Grey area".<sup>3</sup>
- Prediabetes is a high risk state for diabetes with an annual conversion rate of 5-10%.
- According to an ADA expert panel, upto 70% of individuals with prediabetes will eventually develop diabetes.
- According to the most recent clinical practices recommendations published in 2010 by the American Diabetes Association (ADA), Prediabetes is defined as<sup>4</sup>:-
  1. Impaired fasting glucose (IFG) with fasting plasma glucose levels of 100 to 125 mg/dl (5.6 to 6.9 mmol/L)

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2. Impaired glucose tolerance (IGT) with plasma glucose levels of 140 to 199 mg/dl (7.8 to 11.0 mmol/L) 2 hours Post Prandial.
3. An HbA1c of 5.7 to 6.4%.

Association of CKD with diagnosed diabetes is known to be high, but little is known about the prevalence of CKD in those with undiagnosed diabetes or Prediabetes.

- People with prediabetes often have unrecognised CKD. Many people with Prediabetes are found to have 2 signs of kidney disease.
- Protein in urine (called albuminuria)
- Reduced estimated Glomerular Filtration Rate (eGFR)

In people with Prediabetes the stage of CKD can be as advanced as people with diabetes many people with prediabetes can have stage 3 or 4 of CKD. And so Prediabetes may be a target for early intervention, to prevent CKD caused by hyperglycemia. If a patient has borderline elevated glucose levels found by the primary physician, they should start lifestyle changes with respect to diet and physical activity and control of modifiable risk factors like smoking, hypertension and obesity to prevent diseases like diabetes and kidney disease.

## MATERIAL AND METHODS

The present study was conducted at the Department of Medicine with both outdoor & indoor patient at Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur (M.P.) as per criteria recommended by ADA from March 2016 to August 2017 on 100 prediabetic cases and 50 normoglycemic controls.

**Inclusion Criteria: Cases** -1. Patients willing to be a part of study 2. Both men and women > 20 years of age. 3. Patients with FPG  $\geq$  100 mg/dl but  $\leq$  126 mg/dl and/or PPBS  $\geq$  140mg/dl but  $\leq$  199mg/dl and/or HBA1C 5.7 - 6.4% as per American Diabetes Association (ADA) criteria.

**Controls** - Apparently healthy individuals both males and females who are > 20 yrs of age with FPG < 100 mg/dl and/or PPBS < 140mg/dl and/or HBA1C < 5.7%. (Normoglycemic Patients)

**Exclusion Criteria:** 1. Patients who are pregnant. 2. Patients who are known diabetic 3. Patients on Angiotensin Converting Enzyme Inhibitors (ACEI) or Angiotensin Receptor Blockers (ARB) use to treat hypertension/CKD 4. Patients who do not give consent

Patients with risk factors for Pre-diabetes on OPD (Specialty OPD) basis or from wards were taken and screened for Prediabetes as per the ADA criteria

Under aseptic precautions blood samples were drawn in morning (after 12 hours of fasting) and were analysed for plasma glucose.

Blood samples were also drawn 2hrs post meal and were analysed for Post Prandial Blood sugar.

Blood sugar was estimated by Randox autoanalyser using colorimetric method without deproteinisation using glucose oxidase and peroxidase reaction. The values were measured in mg/dl.

Blood samples were drawn for HBA1C (Glycated Hemoglobin).

HbA1c was measured using Latex agglutination inhibition assay.

## To Establish Kidney Disease:-

### Definitions:

#### Estimated Glomerular Filtration Rate

eGFR was calculated according to Modification of Diet in Renal disease (MDRD) Study by measuring serum creatinine.

### Stages

- Stage I - eGFR > 90 ml/min per 1.73 m<sup>2</sup> & presence of Albuminuria at single measurement.
- Stage II - eGFR 60 to 89 ml/min per 1.73 m<sup>2</sup> & presence of Albuminuria at single measurement.
- Stage IIIA - eGFR 45 to 59 ml/min per 1.73 m<sup>2</sup>.
- Stage IIIB - eGFR 30 to 44 ml/min per 1.73 m<sup>2</sup>
- Stage IV - eGFR 15 to 29 ml/min per 1.73 m<sup>2</sup>.

Blood Samples were drawn for Serum Creatinine which was applied in above formula. Serum creatinine level was estimated by Jaffe's method and was measured in mg/dl.

### Albuminuria

- Urinary albumin creatinine ratio of 30 to 300 mg/g (microalbuminuria) and > 300 mg/g (macroalbuminuria).
- Spot urine sample was collected and measured for urine albumin creatinine ratio (UACR).

### Statistical Analysis

All the records were rechecked for their completeness and consistencies. Non numeric entries were coded numerically into nominal/ordinal distribution before analysis. Categorical variables were summarized in frequency and percent distribution and Chi-square or Fishers exact test was performed as appropriate. Continuous variable were

analyzed using mean  $\pm$  SD or median with inter quartile range as appropriate. P value<0.05 was considered to be significant.

## RESULTS

In the present study, mean age of prediabetic cases was (49.05 $\pm$ 14.71) years and mean age of controls was (44.82 $\pm$ 14)years [Table 1].The difference in age group between cases and controls was found statistically significant(Chi Square- 8.08 p value-0.018) and thus as age advances, the prevalence of prediabetes increases. There was no significant difference recorded in distribution of sexes between cases and controls.(Chi Square- 0.34 p value- 0.56).Thus, there was no association between sex and prevalence of prediabetes. 16% cases and none of the controls were in stage 3 and 4 of kidney disease [Figure 1]. Maximum cases and controls were having eGFR> 90 ml/min/1.73m<sup>2</sup>.This difference in eGFR between cases and controls was statistically significant. (Chi Square- 9.65 p value- 0.05). 9% cases and none of the controls showed microalbuminuria. 7% cases and none of the controls showed macroalbuminuria. Thus there was association between albuminuria and Prediabetes [Figure 2].(Chi square- 8.96 p value-0.005).

**Table 1: Characteristics of study population**

Parameters	Mean $\pm$ SD	
	Prediabetic cases	Normoglycemic controls
AGE (years)	49.05 $\pm$ 14.71	44.82 $\pm$ 14
FBS (mg/dl)	111.28 $\pm$ 7.06	77.62 $\pm$ 10.2
PPBS (mg/dl)	171.4 $\pm$ 13.63	116.52 $\pm$ 12.86
HbA1C(%)	6.03 $\pm$ 0.19	4.56 $\pm$ 0.61
UACR (mg/g)	32.45 $\pm$ 76.69	9.61 $\pm$ 7.16
eGFR (ml/min/1.73 m2)	75.8 $\pm$ 21.94	87.52 $\pm$ 15.58

**Table 2: Overall assessment of prediabetic cases**

GFR (ml/min/1.73m <sup>2</sup> )	Macroalbuminuria	Microalbuminuria	No albuminuria
>90	2 (2%)	Nil	54 (54%)
60-89	Nil	Nil	28 (28%)
30-59	2 (2%)	6 (6%)	2 (2%)
15-29	3 (3%)	3 (3%)	0 (0%)
<15	Nil	Nil	0 (0%)

**Table 3: Overall assessment of controls**

GFR (ml/min/1.73m <sup>2</sup> )	Macroalbuminuria	Microalbuminuria	No albuminuria
>90	Nil	Nil	35 (70%)
60-89	Nil	Nil	15 (30%)
30-59	Nil	Nil	0 (0%)
15-29	Nil	Nil	0 (0%)
<15	Nil	Nil	0 (0%)

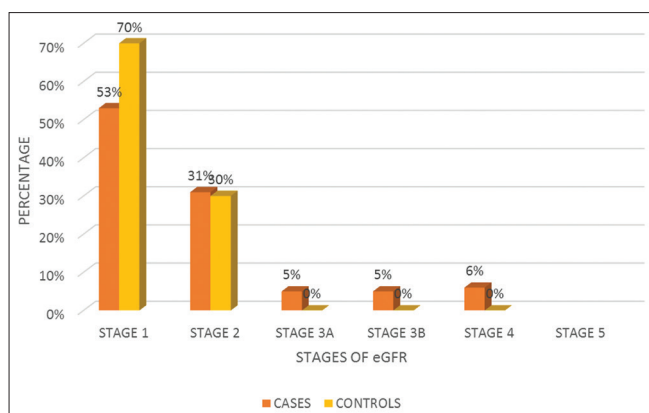
54% cases showed eGFR >90 ml/min/1.73m<sup>2</sup> of which 2% showed macroalbuminuria. 28% cases showed eGFR 60-89 ml/min/1.73m<sup>2</sup>.10% cases showed eGFR 30-59 ml/min/1.73m<sup>2</sup> of which 2% showed macroalbuminuria and 6% showed microalbuminuria. 6% cases showed eGFR 15-29 ml/min/1.73m<sup>2</sup> of which 3% showed macroalbuminuria and 3% showed microalbuminuria. None of the cases showed eGFR <15 ml/min/1.73m<sup>2</sup> [Table 2].70% controls showed eGFR >90 ml/min/1.73m<sup>2</sup> [Table 3]. 30% controls showed eGFR 60-89 ml/min/1.73m<sup>2</sup>. None of the controls showed eGFR 30-59, 15-29, <15ml/min/1.73m<sup>2</sup>. 9% cases showed Microalbuminuria and none of the controls showed Microalbuminuria.7% cases showed Macroalbuminuria and none of the controls showed Macroalbuminuria.16% cases and none of the controls were under stage 3 and 4 of CKD. Overall 18% Prediabetic Cases and no Normoglycemic Controls showed evidence of Kidney Disease. (Chi square- 19.78 p value- <0.0001) [Figure 3].

## DISCUSSION

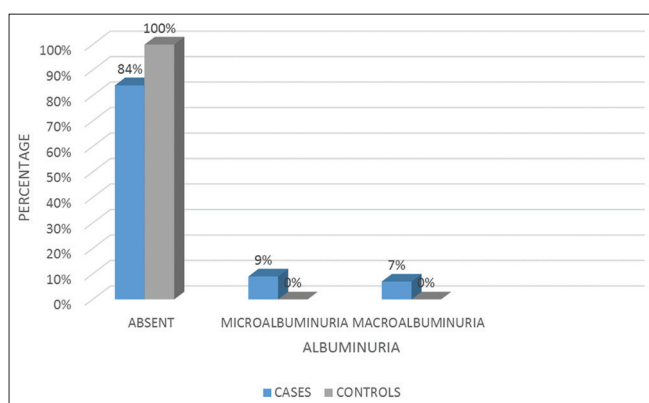
In the present study, 5% cases in stage 3A, 5% in stage 3B, 6 % in stage 4 of eGFR was found.None of the controls were in stages 3 and 4 of eGFR. This difference in eGFR between cases and controls was significant. (Chi Square- 9.65 p value- 0.05).Overall 16% cases were in stage 3 and 4 of CKD.

A study conducted by Platinga LC et al on “Prevalence of Chronic Kidney Disease in US Adults with Undiagnosed Diabetes or Prediabetes”.(2010)<sup>5</sup> showed that of total 17.7% patients with prediabetes and CKD,56.2% had stage 3 and 4 of CKD.This means 9.95% showed stage 3 and 4 of CKD.

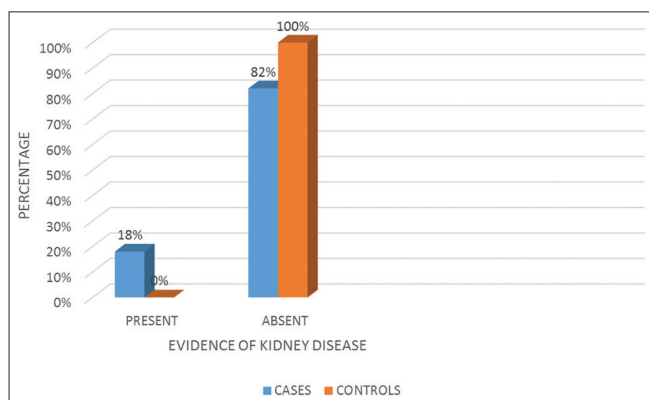




**Figure 1: Estimated glomerular filtration rate in pre diabetic cases and controls**



**Figure 2: Albuminuria in prediabetic cases and controls**



**Figure 3: Evidence of kidney disease in prediabetes**

In contrast study by Zhou et al (2013)<sup>6</sup> showed 14.1% prevalence of CKD in Prediabetes in which only 2.6% showed reduced eGFR.

This difference in eGFR in various studies may be due to difference in study population and different methods of eGFR calculation used. Also duration of hyperglycemia in study population which was not known may cause hyperfiltration followed by reduced eGFR which may also contribute to differences in eGFR.

In the present study albuminuria was found in 16% cases. Microalbuminuria was found in 9% cases (UACR- 30 – 300 mg/g). Macroalbuminuria was found in 7% cases. (UACR->300 mg/g). None of the controls showed microalbuminuria or macroalbuminuria. This difference of albuminuria between cases and controls was statistically significant. (Chi square- 8.96 p value-0.005).

In study conducted by Bahar A, Maklough A et al (2013)<sup>7</sup> on correlation between Prediabetic conditions and Microalbuminuria, prevalence rate of microalbuminuria was 15.5% in prediabetic group. (p value-0.005).

In Monica study on Italian subjects (2007)<sup>8</sup>, the prevalence of Microalbuminuria were 6.9%, 5.6% and 4.3% in IFG, IGT and NGT group respectively.

Whereas in Robyn study in Australia (2004)<sup>9</sup> prevalence of microalbuminuria was 8.3%, 9.9% and 4.3% in IFG, IGT and NGT group respectively.

In study by Zhou et al (2013)<sup>6</sup> Albuminuria was found in 12.9% with Prediabetes (Microalbuminuria-12%, Macroalbuminuria-1%).

This difference in prevalence of albuminuria in various studies may be attributed to differences in the population indices, laboratory techniques for urine albumin measurement, differences in definitions of albuminuria and prediabetes and laboratory techniques to measure it.

The overall evidence of kidney disease was found in 18% cases and none of the controls. This difference in evidence of kidney disease between cases and controls was found to be statistically significant. (chi square – 19.78, p value-<0.0001).

A study conducted by Zhou et al (2013)<sup>6</sup> showed 14.1% prevalence of CKD in Prediabetes and 9.2% in normoglycemic patients. (p value-<0.05).

Similarly study conducted by Platanga LC et al (2010)<sup>5</sup> showed that 17.7% with prediabetes had CKD.

A study by Caroline S. Fox et al on “Glycemic Status and Development of Kidney Disease” (The Framingham Heart Study) (2005)<sup>10</sup> showed that IFG or IGT conferred a 65% increased odds of developing CKD.

Also a study by Shottker B et al on “Prognostic association of HbA1C and fasting plasma glucose with reduced kidney function in subjects with and without diabetic mellitus.” (2013)<sup>11</sup> showed that Relative Risk (RR) of IFG to develop reduced kidney function (RKF) was 0.97 (95%CI: 0.75-1.25) and HbA1C defined prediabetes was 1.03 (95%CI: 0.86-1.23).

## CONCLUSION

Kidney disease prevalence is high among people with prediabetes. Thus, prediabetes can be a target for early intervention by lifestyle changes and control of modifiable risk factors for preventing and/or progression of CKD in these individuals which is the need of the hour in countries like India, which is experiencing the epidemiological transition of chronic non-communicable disease.

## Limitations

1. Small sample size.
2. Study design does not allow us to follow the development of CKD.
3. Duration of Prediabetes was not known, longer duration of hyperglycemia increases risk of CKD.
4. There may be some misclassification of early stages of CKD as a result of limitation in GFR estimation and single spot urine measurement.
5. Some transient albuminuria is possible (especially among women who may have urinary tract infection or may be menstruating).

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# Role of Platelet-rich Plasma on Nasal Mucociliary Clearance after Septoplasty - A Randomized Clinical Study

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## Abstract

**Background:** Intranasal surgeries include septoplasty, endoscopic sinonasal surgeries, and endonasal dacryocystorhinostomy for different indications. During the post-operative period, the patients frequently encounter problems due to the absence of nasal mucociliary clearance (NMC) such as dryness of the nasal mucosa, crusting, bleeding from the nose, and halitosis. The present study is conducted to find the efficacy of using platelet-rich plasma (PRP) on NMC at the end of septoplasty surgery.

**Aim of the Study:** The aim is to study the efficacy of douching the nasal cavity with PRP following septoplasty in terms of recovery of normal mucociliary function and prevention of crusting.

**Materials and Methods:** A single-blinded, randomized, prospective study involving 74 patients divided into two groups. Group A consisted of 37 septoplasty patients in whom plasma rich with platelets was instilled in the nasal cavity and Group B 37 subjects used as control group in whom normal saline was used. Patients followed up at the 7<sup>th</sup> post-operative day and after 2 weeks. NMC was assessed pre-operatively and post-operatively. The incidence of crust formation was also observed in both the groups.

**Observations and Results:** NMC was improved in both the groups, but there was a statistical significant early restoration of NMC in Group A. Crust formation was lower in Group A (PRP group).

**Conclusions:** Application of PRP was an effective method of recuperating nasal mucociliary function in patients undergoing septoplasty decreasing the time taken to return to normal nasal function. PRP also reduced the incidence of crust formation.

**Key words:** Dysfunction, Endoscopic sinus, Mucociliary, Plasma, Platelets, Saccharin clearance

## INTRODUCTION

Indications for the various intranasal surgeries include inflammatory and allergic sinonasal diseases, benign and malignant tumors of the nose, and paranasal sinuses. They are being performed extensively after the introduction of sinus endoscopes. Apart from these various approaches through nasal cavities such as to lacrimal system, pituitary fossa is being carried out in every part of the world. At the end of the surgery, large cavities are left to heal which depends on the pre-operative mucosal status and NMC

of that particular patient. All age groups are subjected to these surgeries. NMC mechanism helps as nature's best air conditioner and protects the upper as well as lower respiratory tracts and the delicate alveoli. The mucous film, with its immunological active ingredients, its adsorbent power, and its water content, makes the inhaled air almost sterile, sufficiently humid and at par with the body temperature. This mucociliary mechanism can be easily impaired by structural abnormalities of the nose and paranasal sinuses.<sup>[1]</sup> Andersen *et al.*<sup>[2]</sup> used a method of depositing a small particle of saccharine on the nasal mucosa and noting the time that it took the subject to report a sweet taste to calculate and assess the NMC. The values for mucociliary clearance have been reported in different parts of the world with wide variations depending on various geographical, physiological, and pathological conditions.<sup>[3-6]</sup> The reliability and validity of the saccharin test were previously confirmed by Puchelle *et al.*<sup>[7]</sup> Platelet-rich plasma (PRP) was first used in cardiothoracic surgery

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by M. Ferariwho used PRP in 1987 after an open heart surgery; now, it is widely used in various fields such as dentistry, orthopedics, otorhinolaryngology, maxillofacial surgery, dermatology, plastic and cosmetic surgery, urology, and wound healing.<sup>[8]</sup> Platelets isolated from the blood form a rich autologous source of growth factors. When PRP is applied to the surgical site, more predictable outcome can be expected. A blood clot is the important factor in soft tissue healing in all natural wounds. PRP behaves in a similar strategy initiating a more rapid and complete healing process. A natural blood clot usually contains 95% red blood cells (RBC's), 5% platelets, and <1% of white blood cells (WBCs) and numerous amount of fibrin strands. A PRP blood clot contains 95% of platelet, 4% of RBC's and 1% of WBC's.<sup>[9]</sup> Autologous PRP also has a potential for use as a hemostatic agent because it binds tissues and locally activates the coagulation cascade. When the coagulation cascade is activated, high concentrations of platelets adhere to the wound surface. Platelet activation and degranulation release a number of hemostatic substances.<sup>[10]</sup> Post-operative treatment consisted of the standard protocol of systemic cephalosporin antibiotic, nonsteroidal anti-inflammatory drugs, and multivitamins for 1 week. In the present study, post-operative NMC was assessed by the saccharin test preoperatively as well as 3 months after surgery (functional endoscopic sinus surgery [FESS]) under the same climatic conditions (room temperature 23°C and relative humidity 60%).

### Aim of the Study

The aim is to study the efficacy of applying topically PRP following intranasal surgeries in terms of recovery of normal mucociliary function and preventing crusting.

### Study Period

The study period was from April 2014 to March 2016.

### Institute of Study

The study was conducted at Kurnool General Hospital Attached to Kurnool Medical College, Kurnool, A. P.

## MATERIALS AND METHODS

In the present study, 74 patients undergoing septoplasty were randomly selected using online services for random selection ([andrew.hedges.name/experiments/random](http://andrew.hedges.name/experiments/random)). They were divided into 2 groups. Group A consisted of 37 patients in whom PRP was instilled at the end of the surgery. Group B consisted of 37 patients in whom normal saline was instilled at the end of the septoplasty. Inclusion criteria: (1) Patients aged above 18 years and below 47 years were included. (2) Patients undergoing septoplasty for the time were included. (3) Patients with

primary disease without complications were included. (4) Patients with congenital anomalies of the choanae were included. Exclusion criteria: (1) Patients aged below 18 years and above 47 years were excluded. (2) Patients with diabetes mellitus and endocrine disorders were excluded. (3) Patients on mucoregulatory drugs 2 weeks before surgery were excluded. The platelet rich with plasma was prepared by the following method:<sup>[10]</sup>

### Preparation of Autologous PRP

1. 50 mL of blood was drawn from the patient and placed in a five 10 mL test tubes with 1.4 mL anticoagulant citrate phosphate dextrose adenine (cpda-1) solution in each one aseptically. Fluid replacement may be needed for sensitive patient after drawing of blood.
2. This was centrifuged with a soft spin at 2500 rpm in 5 min.
3. The centrifuged was stopped to allow a 60-s countdown to help loosen platelets. The concentrated platelet was collected with the buffy-coat, and the RBCs are discarded.
4. After the 60-s countdown, a hard spin was allowed at 3500 rpm in 10 min and the PRP was collected which is in the bottom of the test tube, and buffy coat was drawn up using a pipette and discarded. The test tube was then transported in the surgical field. Note: The remaining 1–2 cc of plasma was used to resuspend the concentration of platelets and white cells.

The test tube was labeled PRP. It was instructed to continuously shake the test tubes while on transport or waiting douching. Pre-operative nasal mucociliary clearance time (NMCT) was calculated with saccharin test by the following method:<sup>[11]</sup> NMC was assessed using the saccharin transit time (ST) test on the 1<sup>st</sup> day of the study as a baseline before severe mucosal damage (SMD) (patients with ST >30 min were excluded) and was done after 2 weeks and 2 months postoperatively. The patients were seated comfortably in the test room with constant humidity and room temperature of 20–22°C for at least 20 min to keep them in a stable physiological and environmental state while instructions were given before testing. A 5 mg of saccharin particle was applied on the inferior turbinate 1.5 cm from the nares under direct visualization. After placement of saccharin, the patient was asked to refrain from sneezing, sniffing, or bending. The transit time was recorded from the placement of the saccharin on the inferior turbinate until the patient reported a sweet taste to the nearest minute. 30 min was set as the upper limit of the normal. All the patients undergoing surgery were thoroughly investigated and surgical profile was done. After surgery, PRP was instilled/douched into the nasal cavity taking care that the entire operation sites were in contact with PRP. Nasal cavities were packed to avoid oozing of



blood wherever necessary. Patients were followed up on 3<sup>rd</sup>, 7<sup>th</sup> post-operative day, and after 2 weeks. NMCT with saccharin test was calculated postoperatively after 7<sup>th</sup> post-operative day after 2 weeks (2 values were recorded). All the data collected were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Of 74 patients in Group A, there were 23 males and 14 females with a male-to-female sex ratio of 1.64:1. These patients were in the age groups of 18–47 years with a mean age of  $26.35 \pm 2.60$  (95% confidence interval). In Group B, there were 22 males and 15 females with a male-to-female sex ratio of 1.46:1. These patients were in the age groups of 18–47 years with a mean age of  $28.20 \pm 1.90$  [Tables 1 and 2].

Pre-operative NMCT measured in both the groups is shown in Table 3, and there was no statistical significant difference between Groups A and B before septoplasty and the  $P = 0.014$ . Apart from NMCT, there were no post-operative incidences in either group. Post-operative pain was complained in 5/37 in Group A and 7/37 (18.91%) of Group B. Crusting was reported in 3/37 (8.105) of the Group A and 11/37 (29.72%) of the Group B which was statistically significant difference.

**Table 1: The age and gender incidence of the Group A patients (n=37)**

Age groups	Male	Female	Percentage
18–24 (10)	05	05	27.02
25–31 (13)	07	08	35.13
32–39 (09)	05	04	24.32
40–47 (05)	03	02	13.51

**Table 2: The age and gender incidence of the Group B patients (n=37)**

Age groups	Male	Female	Total percentage
18–24 (11)	06	05	29.72
25–31 (12)	07	05	32.43
32–39 (08)	05	03	21.62
40–47 (06)	03	03	16.21

**Table 3: The difference in NMCT values pre-operatively (n=74)**

Group and number	Mean and SD	Mean difference	T	P
A-37	14.99±4.20	1.02	4.45	0.014
B-37	16.01±4.10			-

NMCT: Nasal mucociliary clearance time, SD: Standard deviation

In Group A, NMC mean was  $14.99 \pm 4.20$  before the operation and on 7<sup>th</sup> day and after 2 weeks postoperatively, NMC mean was  $13.38 \pm 3.80$  and  $11.25 \pm 3.20$ , respectively, the  $P$  value in this group was highly significant 0.008 [Table 4]. In Group B, pre-operative NMC mean was  $16.01 \pm 4.10$ , and on 7<sup>th</sup> day and 2 weeks later after operation, was  $15.73 \pm 4.65$  and  $13.87 \pm 4.46$ , respectively, and the  $P$  value was less significant (0.038) than in Group A [Table 5]. Comparison between pre-operative and post-operative NMCT values in each group at biweekly intervals showed a statistical significance in the values of Group A [Table 4].

## DISCUSSION

Nasal obstruction is a common presenting symptom in otolaryngology. Most patients having septal deviation will have hypertrophied inferior turbinate on the opposite side due to nature's compensation mechanism. In the extensive study of neonatal septal deviation by Gray,<sup>[12]</sup> the incidence of deviated nasal septum was found to be 48–60%. However, Jeppensen and Windfield,<sup>[13]</sup> Jazbi,<sup>[14]</sup> and Alpini *et al.*<sup>[15]</sup> found an incidence of <4%. Septal deviation is corrected by septoplasty but the treatment of hypertrophied inferior turbinate by a wide range of surgical methods. Intranasal surgeries are fraught with early complications including bleeding, adhesion, and persistent nasal obstruction (due to edema and crust formation) remain as problems which lead to the search for minimal invasive surgeries.<sup>[16]</sup> There is certain controversy remaining in the appropriate surgical treatment of the inferior turbinate hypertrophy because the hypertrophy tends to recur after most treatments.<sup>[17]</sup> Early recovery of NMC would avoid the early complications mentioned above. The PRP contains multiple growth and healing factors such as platelet-derived growth factor, transforming growth factor, and vascular endothelial growth factor. The

**Table 4: The mean with SD and P values of Group A NMCT values, (n=74)**

Time of NMCT	Mean with SD	P
Pre-operative	16.01±4.10	-
7 <sup>th</sup> day	15.73±4.65	-
After 2 weeks	13.87±4.46	0.008

NMCT: Nasal mucociliary clearance time, SD: Standard deviation

**Table 5: The mean with SD and P values of Group B NMCT values, (n=74)**

Time of NMCT	Mean with SD	P
Pre-operative	14.99±4.20	-
7 <sup>th</sup> day	13.38±3.80	-
After 2 weeks	11.25±3.20	0.038

NMCT: Nasal mucociliary clearance time, SD: Standard deviation

release of these factors is triggered by the activation of platelets which can be initiated by a variety of substance or stimuli such as thrombin, calcium chloride, collagen, or adenosine 5c-diphosphate; in addition to these growth factors, PRP contains fibrinogen and a number of adhesive glycoproteins that support cell migration.<sup>[18]</sup> In this study, there was no statistical difference in mucociliary clearance between Group A and Group B before the operation as  $P = 0.014$  [Table 1]. It means that both groups were randomly selected and there was no statistical bias which allows comparing mucociliary clearance postoperatively in both groups. Post-operative pain was complained in 5/37 of Group A and 7/37 (18.91%) of Group B. Crusting was reported in 3/37 (8.105) of the Group A and 11/37 (29.72%) of the Group B which was statistically significant difference. Even though the study is based on small data and shorter duration, the raised the importance of PRP in decreasing crust formation and bleeding after septoplasty cannot be ignored. In the present study, NMC in Group A patients was improved postoperatively and this improvement increased at 2 weekly post-operative NMCT calculated with  $P$  value at 0.008 ( $P$  was considered statistically significant at 0.05), [Table 4]. On the other hand, the NMC clearance improvement in Group B patients was more at 2 weeks ( $P = 0.038$ ), [Table 5]. The improvement of mucociliary clearance in Group A ( $P = 0.008$ ) was more compared to Group B ( $P = 0.38$ ). The improvement in NMC was more at 2 weeks postoperatively because of less crust formation and more healing of mucosa at that time. The present study concludes that using PRP has shown early recovery of NMC and lesser crust formation in the post-operative period.

On the contrary, Rice<sup>[19]</sup> was not happy about the use of PRP as the studies conducted by him and showed no benefits in the application of PRP after endoscopic sinus surgery, and the study was terminated early after 13 operations. In a similar study by Jakse *et al.*<sup>[20]</sup> on the effects of PRP on bone regeneration after sinus lifting, they found a 3–4% increase in bone generation with PRP, the difference was not statistically significant, and the regenerative capacity of PRP was described as being of “quite low potency.” These previous research studies implied no significant effect in the application of PRP after surgery, this may be because the surface area needed for healing is large and cannot be covered all with PRP; this is because with current harvesting techniques, 20 ml of a patient’s blood yields only 2–3 ml of PRP. In the present study, the topical application of PRP was significant in the improvement of NMC because the surface area needed for healing is not so large, and also, there is a less mucosal injury with SMD. Erkilet *et al.* suggested that PRP is effective in accelerating tympanic membrane perforation healing in rats and that it may be effective in human subjects, particularly

as it is an autologous material.<sup>[21]</sup> The idea in Erkilet *et al.* study is similar to the present study in terms of the small surface area needed for healing. Furthermore, Man *et al.* described the benefits of the use of PRP in cosmetic surgery.<sup>[22]</sup> Adler and Kent reported the advantage of using PRP in face-lifts.<sup>[23]</sup> Finally, Abuzeni and Alexander reported the benefits of PRP in autologous fat transfer in cosmetic surgery.<sup>[24]</sup> As this study is only with 74 subjects, further studies are needed on larger numbers of patients with a longer period of follow-up to evaluate the effect of adding PRP on nasal ciliary functions and healing of nasal mucosa after various nasal surgeries.

## CONCLUSIONS

Using PRP in septoplasty gives a chance for the nasal mucosa to recover NMC, especially within 2 weeks. Adding PRP is added at the end of intranasal surgeries which leave a large aw surfaces especially after FESS, there will be a greater improvement of NMC with less bleeding and crust formation. PRP is simple and easy to be prepared with no reported side effects.

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# Clinical Study of Visual Outcome and Intraocular Pressure Changes Following Neodymium-doped Yttrium Aluminum Garnet Laser Capsulotomy in Post-operative Cataract Patients with Posterior Capsule Opacification

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## Abstract

**Background:** The use of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser procedure for posterior capsulotomy has been gradually replacing the surgical capsulotomy as it is less invasive, and can be performed as an outpatient procedure.

**Objectives:** The objectives of the study were to analyze the clinical results in terms of visual outcome, intraocular pressure (IOP) changes, and complications following Nd:YAG laser capsulotomy in small incision cataract surgery (SICS) and phacoemulsification surgery with posterior chamber intraocular lens.

**Methods:** The study was conducted in the Department of Ophthalmology, Government General Hospital, Kakinada. Over a period of 20 months, data of 100 numbers of post-operative patients coming with diminished vision due to posterior capsular opacification following cataract surgery were gathered after conducting Nd:YAG laser capsulotomy.

**Results:** Complications in Nd:YAG laser are minimal and transient. Improvement of visual acuity (VA) was excellent following Nd:YAG laser capsulotomy in SICS and phacoemulsification surgeries. VA improved to 6/6 in 16 cases, 6/9 in 36 cases, 6/12 in 16 cases, 6/18 in 10 cases, 6/24 in 8 cases, 6/36 in 7 cases, and 6/60 in 4 cases.

**Conclusion:** Nd:YAG capsulotomy is a safe procedure. Since significant pressure spikes occur, after laser procedure, it is important to put the patients on topical timolol maleate 0.5% drops. IOP after 1 h, 4 h, and 1 week is important. When the patient comes for follow-up after 1 week, 4 weeks, and 24 weeks, it is important to look for cystoid macular edema and retinal detachment and endophthalmitis.

**Keywords:** Cataract, Neodymium-doped yttrium aluminum garnet laser, Posterior capsular opacification

## INTRODUCTION

A posterior capsular opacification (PCO) occurs after cataract surgery. After a cataract operation, symptoms such

as blurred, hazy vision, or having lot of glare from lights, may be due to a PCO. Blurring and loss of vision from PCO is usually gradual, just as with real cataracts. While the symptoms are very similar to cataracts, there is no chance of an actual cataract reforming after cataract surgery.

During a cataract operation, the surgeon will carefully remove the cataract from the affected eye, and replace it with an artificial intraocular lens (IOL). The lens is located within a very thin membrane “bag” called the capsule. The front of the capsule must be opened to remove and insert the lenses. The back or “posterior” of the capsule remains

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intact to support the new lens. In a small proportion of patients – around 10% – the outer cells of the old lens remain and grow on the capsule. This causes the capsule to become hazy or clouded, which results in blurred vision. The treatment for PCO is very simple. A procedure called a YAG laser capsulotomy is used to remove the haziness and restore normal vision. It is a fast, painless, and very effective treatment. Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser capsulotomy is a relatively non-invasive procedure that is used in the treatment of PCO. PCO is a common long-term complication of cataract surgery that causes decrease vision, glare, and other symptoms similar to that of the original cataract.<sup>[1]</sup> PCO is caused by a proliferation of lens epithelial cells which causes fibrotic changes and wrinkling of the posterior capsule. Its reported frequency varies from 8.7% to 33.4%.<sup>[2]</sup>

PCO is one of the common complications of extracapsular cataract extraction surgery and develops within 2 years after cataract extraction in 50% of the cases.<sup>[3,4]</sup> It causes reduction in visual acuity (VA) and contrast sensitivity by obscuring the view or by scattering the light that is perceived by patients as glare.<sup>[5]</sup>

It also decreases the field of view during therapeutic and diagnostic procedures and also causes unocular diplopia.<sup>[6]</sup> In younger age group, it develops earlier, but in elderly, its incidence declines.<sup>[7]</sup> Since the use of Nd:YAG laser for posterior capsulotomy, the procedure has been gradually replacing the surgical capsulotomy as it is less invasive, and can be performed as an outpatient procedure.<sup>[8]</sup> Hence, in the present study is to study the visual outcome, intraocular pressure (IOP) changes, and complications following Nd:YAG laser capsulotomy.

## MATERIALS AND METHODS

The study was conducted in the Department of Ophthalmology, Government General Hospital, Kakinada. The patients who were pseudophakic were considered for the study. The study design was hospital-based cross-sectional study and sampling techniques used was purposive sampling. Over a period of 20 months (December 2014–August 2016), data of 100 numbers of post-operative patients coming with diminished vision due to PCO following cataract surgery were gathered after conducting Nd:YAG laser capsulotomy. A thorough pre-operative assessment was made to confirm the visual loss due to PCO. After Nd:YAG laser capsulotomy, IOP was recorded every 1 h, 4 h, and 1 week to look for any pressure spike. Cases were followed up after 1 week, 4 weeks, 12 weeks, and 24 weeks and looked for any complications such as cystoid macular edema (CME), retinal detachment, rise of IOP, and persistent iritis. Complications such as transient

rise of IOP, vitritis, bleeding from iris, pitting of IOL, and iritis have been reported in the study.

The data of the 100 post-operative patients were analyzed based on the following criteria, namely, complete ophthalmic and medical history, detailed examination of both eyes along with general physical examination, VA testing with Snellen chart, examination of anterior segment of eye by slit lamp biomicroscopy, examination of posterior segment of eye by direct and indirect ophthalmoscopy, and +90 D biomicroscopy, measurement of IOP, evaluation regarding treatment given including Nd:YAG laser capsulotomy and systemic and topical drugs given. The patients were interviewed, and clinical evaluation was conducted during the follow-up intervals of 1 week, 4 weeks, 12 weeks, and 24 weeks.

The study protocol was approved by the Institutional Ethics Committee. Informed consent was collected from the participants and confidentially was assured. A semi-structured pro forma was used for recording the socioeconomic profile, methods, situation about the vision loss, intent, methods, and clinical profile of the patient. Ophthalmic diagnosis was made according to diagnosis criteria for research of international classification of diseases - 10 by the researchers.

Inclusion criteria of patient for the study are patients having posterior capsular thickening/opacification on examination with slit lamp, patients having decrease in vision by at least 3 lines on Snellen chart, patients with at least 3 months interval between cataract surgery and development of PCO.

Patients who were excluded from the study are patients having <5 years of age, patients with subluxated IOL, patient having post-operative complications like endophthalmitis, uncooperative patients such as mental retardation, neurological problems, and patient having PCO in aphakic eyes.

## RESULTS

The study was conducted after a short-term study of 6 months and the following observations were made, 100 patients were identified having PCO diagnosed by retinoscopy, slit lamp examination, and direct and indirect ophthalmoscopy. These cases were divided according to age and sex, and also according to the duration between cataract extraction and development of PCO. PCO was graded based on view of fundus details and Nd:YAG laser capsulotomy done for all the cases. Pre-laser and post-laser VA were recorded, compared, and analyzed. Safety, efficacy, and post-laser complications of Nd:YAG laser were recorded, followed, and treated.

About 56% of the patient had PCO in the right eye, and 100 samples were selected during 6 months, which included sample size of 52% males and 48% females. The average age of the patient was 40–80 years. 9% of the patient were under 40 years, 48% of the patient selected were in the age group between 40 and 60 years, and 40% of the patient selected were in the age group above 60 years Table 1.

The period between cataract extraction and development of PCO was found mostly at an early stage, i.e., within 1–20 months. A large proportion of these patients about 68% had the diagnosis of PCO within 1–12 months after surgery, 22% diagnosed within 12–36 months after surgery, and 10% developed PCO after 36–60 months after surgery.

After clinical evaluation through both direct and indirect ophthalmoscopy, the nature of the PCO was graded as mild, moderate, and severe categories. PCO diagnosed based on fundus details is severe PCO (Grade 3) were about 24%, moderate (Grade 2) were 52%, and mild (Grade 1) were 24%.

The duration of follow-up for Nd:YAG laser procedure was 4 h and 1 week. Overall, 100 patients were on Nd:YAG laser procedure. Among them, complications of vitritis (8%), rise in IOP (40%), pitting of IOL (6%), hyphema (4%), and iritis (32%) were noticed. The rise in IOP (40%) is the most common complication.

There was a remarkable and significant difference and improvement in VA of the Nd:YAG laser capsulotomy. Overall, 97% of the patients studied had visual improvement. However, 3% of the patients did not have visual improvement. VA improved to 6/6 in 16 cases, 6/9 in 36 cases, 6/12 in 16 cases, 6/18 in 10 cases, 6/24 in 8 cases, 6/36 in 7 cases, and 6/60 in 4 cases.

In the study, there was rise of IOP up to 2 mmHg within 4 h was 40%, 6% cases showed IOP rise of 3 mmHg, and 2 cases showed rise of 5 mmHg. In 49% of cases, there was no change. After 1 week, 14% cases showed rise of IOP by 2 mmHg, 3% cases showed rise by 3 mmHg, and 82% cases showed no change of IOP compared to pre-laser IOP. Almost cases came to precapsulotomy state within 4 weeks. Since all the cases have been given topical timolol maleate 0.5% rise of IOP was minimal Tables 2 and 3.

## DISCUSSIONS

PCO is a major complication of cataract surgery with or without IOL implantation. The use of Nd:YAG laser has definitely simplified the treatment of PCO. Another great advantage is that is entirely non-invasive. In the study of 100 cases, the main aim was to evaluate the results of Nd:YAG laser capsulotomy in 100 patients. All the

100 patients had VA improvement of 1 or more lines after capsulotomy. No one had further declined in VA after capsulotomy.

### Age of Presentation of PCO

The average age of presentation of PCO in patients under 40 years of age is within 1 year, followed by 2 years in the age group 42–60 years. Hence, it can be stated that younger the age earlier will be the PCO. The average age of presentation of PCO was 50 years and similar in the studies of Kundi and Younas<sup>[9]</sup> and Bari *et al.*<sup>[10]</sup>

### Time Period Between Cataract Extraction and Nd:YAG Laser Capsulotomy

In the study, the average period between cataract extraction and performing Nd:YAG laser posterior capsulotomy was 19 months which are similar with the studies of Kundi and Younas<sup>[9]</sup> and Bari *et al.*,<sup>[10]</sup> whereas from the study of Hasan *et al.*,<sup>[11]</sup> the time period is 2 months.

### Predominant Type of PCO

The most common type of PCO is capsular fibrosis which is similar to the studies of Kundi and Younas<sup>[9]</sup> and Bari *et al.*<sup>[10]</sup> but differed from the study of Hasan *et al.*,<sup>[11]</sup> who reported Elschnig's pearls as the most common type of PCO in pseudophakic eyes and secondary fibrosis in aphakic eyes.

### Quantification and Grading of PCO

In the present study, grading of PCO is done using direct and indirect ophthalmoscopy and divided into mild, moderate, and severe types of PCO.

### Complications After Nd:YAG Laser Capsulotomy

In the study, rise in IOP is the most common complication followed by iritis, vitritis, pitting of IOL, and lastly hyphema which was also the same complication seen in the studies. The rise in IOP is only transient. There is no permanent rise in IOP except in known glaucoma cases. This rise in IOP can be prevented by giving pre-laser anti-glaucoma medication and prescribing anti-glaucoma medications such as 0.5% timolol eye drops and tablet Diamox 250 mg BD after capsulotomy. Although there is transient rise in IOP at the end of 4 h, there is no much change in IOP at the end of 1 week.

In some of retrospective studies conducted by Gorel<sup>[12]</sup> and Kundi and Younas,<sup>[9]</sup> it was found that addressed IOP changes after Nd:YAG capsulotomy. In the study, it is highlighted that increase in the IOP was significantly related to the IOP measurement 1 h after the capsulotomy, whereas the difference between baseline and final IOP at 1 week was not significant. Similar study was done by Slomovic and Parrish<sup>[13]</sup> who proved that in patients with no prior history of glaucoma, the use of prophylactic anti-

**Table 1: Characteristics of the ophthalmology patients in government general hospital, kakinada, andhra pradesh (n=100)**

Characteristics	Number of cases (%)
Gender	
Male	52 (52)
Female	48 (48)
Age	
<40	9 (9)
40–60	48 (48)
>60	40 (40)
PCO in eye	
Light eye	44 (44)
RE	56 (56)
Time period between cataract extraction and development of PCO (in months)	
1–4	23 (23)
5–8	20 (20)
9–12	25 (25)
13–20	22 (22)
36–60	10 (10)
Grading of PCO	
Grade 1 - Mild (fundus seen with direct ophthalmoscope)	24 (24)
Grade 2 - Moderate (fundus seen with indirect ophthalmoscope)	52 (52)
Grade 3 - Severe (no fundus view or details hazily see)	24 (24)

RE: Right eye, PCO: Posterior capsular opacification

**Table 2: Complications of Nd: YAG laser posterior capsulotomy procedure**

Complications	Number of eyes (%)
Types of complications	
Vitritis	8 (8)
Rise in IOP (transient)	40 (40)
Pitting of IOL	6 (6)
Hyphema	4 (4)
Iritis	32 (32)
Number of complications following post Nd: YAG laser	
Number of eye having no complication	38 (38)
Number of eyes having only one complication	44 (44)
Number of eyes having more than one complication	18 (18)
Total complications	
Percentage of complications with Nd: YAG laser	38 (38)
Rise in IOP after Nd: YAG laser posterior capsulotomy	
IOP	<4 h 1 week
No change	49 82
1–2 mmHg	40 14
3–4 mmHg	6 3
>5 mmHg	2 1

IOP: Intraocular pressure, Nd: YAG: Neodymium-doped yttrium aluminum garnet

and shock wave damage to the trabecular meshwork. Acute inflammatory cells and capsular debris cause increased IOP by demonstrating pigment granules, erythrocytes, fibrin, lymphocytes, and macrophages within the trabecular

glaucoma medications was not indicated since the IOP elevation within the first 24 h appeared to be a self-limited process in most cases.

Flohr *et al.*<sup>[14]</sup> also found that a short-term IOP elevation after capsulotomy was more common in glaucomatous than in non-glaucomatous eyes in which transient immediate post-laser IOP elevation was seen in 25% of non-glaucomatous eyes.

On the other hand, Channell and Beckman<sup>[15]</sup> and Awan and Kazim<sup>[16]</sup> proved significant IOP elevation post-YAG CAP who were treated with anti-glaucoma medications. In a US food and drug administration report of 2110 Nd:YAG capsulotomies, the major post-operative complication was elevation of IOP.<sup>[17]</sup> The maximum IOP increase occurred between 1.5 and 4 h, and usually returned to baseline within 24 h after treatment, whereas in the study, maximum IOP increase occurred between 1.5 and 4 h without any anti-glaucoma treatment.

Steinert *et al.*<sup>[18]</sup> estimated an incidence of glaucoma developing in 1–6% of patients after capsulotomy which was only 3.75% cases in the study. Leys *et al.*<sup>[19]</sup> studied 67 eyes of 65 patients for 2 months after capsulotomy and documented a statistically significant decrease in IOP compared with the precapsulotomy IOP. Similarly, Fourman Sapisson,<sup>[20]</sup> Jahn *et al.*,<sup>[21]</sup> and Ge *et al.*<sup>[22]</sup> studied long-term effect of YAG capsulotomy on IOP elevation.

Other incidences of associated complications following Nd:YAG laser capsulotomy are:

### Increased IOP

Elevated IOP is the most common, although usually transient, complication following Nd:YAG laser capsulotomy. IOP elevations >10 mmHg have been observed in 15–67% of eyes. IOP typically begins to rise immediately after the laser capsulotomy, peaks at 3–4 h, decreases but may remain elevated at 24 h, and usually returns to baseline at 1 week. Rarely, IOP remains persistently elevated, causing visual field loss requiring glaucoma surgery, or both. Acute IOP increase may cause loss of light perception vision.<sup>[23]</sup> Elevated IOP has been associated with preexisting glaucoma, capsulotomy size, lack of a posterior chamber IOL, sulcus fixation of a posterior chamber IOL, laser energy required for the capsulotomy, myopia, and preexisting vitreoretinal disease. Reliable in-the-bag fixation of posterior chamber IOLs has vastly reduced the incidence of clinically significant elevation of IOP after Nd:YAG laser capsulotomy.<sup>[23]</sup> Increased IOP following Nd:YAG laser capsulotomy is associated with a reduced facility for aqueous humor outflow. This reduction has been attributed to capsular debris, acute inflammatory cells, liquid vitreous,



**Table 3: VA improvement after Nd: YAG posterior**

Capsulotomy pre-laser VA	Post-laser VA								Total
	6/6	6/9	6/12	6/18	6/24	6/36	6/60	Lost for follow up	
6/9	3	0	0	0	0	0	0	0	3
6/18	3	1	0	0	0	0	0	0	4
6/24	5	1	0	0	0	0	0	0	6
6/36	3	9	2	1	2	0	0	0	17
6/60	2	23	4	3	1	2	0	1	36
CF 1 mt	0	0	1	2	2	2	1	1	9
CF 2 mt	0	1	4	2	1	3	1	0	12
CF 3 mt	0	0	1	0	0	0	1	0	2
CF 4 mt	0	0	2	0	1	0	0	0	3
CF 5 mt	0	1	1	2	1	0	0	0	5
CFCF	0	0	0	0	0	0	0	1	1
HM	0	0	1	0	0	0	1	0	2
Total	16	36	16	10	8	7	4	3	100

$P < 0.000$ ,  $P > 0.002$ . VA: Visual acuity, Nd: YAG: Neodymium-doped yttrium aluminum garnet

### Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	179.048 <sup>a</sup>	84	0.000
Likelihood Ratio	126.631	84	0.002
Number of valid cases	100		

<sup>a</sup>100 cells (96.2%) have expected count  $< 5$ . The minimum expected count is 0.03

meshwork after laser capsulotomy. Glaucomatous eyes may have increased frequency and magnitude of IOP elevation as they already have a reduced outflow facility.<sup>[24]</sup> Liquid vitreous as the cause of outflow obstruction is supported by the clinical association between increased IOP following laser treatment and myopia, preexisting vitreoretinal disease, lack of a posterior chamber IOL, and sulcus-fixated posterior chamber IOLs. A capsule-fixated posterior chamber IOL and a smaller capsulotomy may provide a barrier effect, preventing liquid vitreous from reaching the anterior chamber and trabecular meshwork. Liquid vitreous injected into the anterior chamber in owl monkey eyes was found to increase IOP. Nd:YAG laser-induced shock waves causing increased IOP resulting in damage to the trabecular meshwork have been supported clinically by the association between increased IOP and higher total laser energy used to create the capsulotomy. Photodisruption pulses in the aqueous of the mid-anterior chamber have not been associated with increased IOP, nor have there been microscopic evidence of damage to the trabecular cords.<sup>[25]</sup> Prevention of the IOP increase is appropriate. Apraclonidine, brimonidine, timolol, levobunolol, and pilocarpine decrease the frequency and magnitude of IOP increases. Apraclonidine is most effective. Apraclonidine, timolol, levobunolol, or other beta-adrenergic antagonists are administered 1 h before the procedure and again following the procedure. Pilocarpine should be administered only postoperatively due to its

miotic effect. Patients at high risk for IOP elevation or with vulnerable optic nerves should be carefully monitored following the procedure as prophylactic therapy may not prevent late IOP increases. IOP following Nd:YAG laser capsulotomy may also be elevated by vitreous obstruction of a sclerostomy, the development of neovascular glaucoma, or pupillary block glaucoma. Patients with existing glaucoma or where high IOP developed acutely after capsulotomy may have long-term elevated IOP.<sup>[23]</sup> Elevation of IOP has been well documented after virtually all anterior segment laser surgeries. The IOP rise after Nd:YAG laser posterior capsulotomy may be absent or transient. Early researchers such as Aron-Rosa *et al.*<sup>[26]</sup> did not find any permanent elevation of IOP, but subsequent studies revealed that it might occur. Keates *et al.* found elevation of IOP in 0.6% of his patients, whereas Stark *et al.* reported 1.0% in their study. Ge *et al.* found that rise in IOP is more pronounced in patients with glaucoma and in those who experienced a higher rise of IOP within hours of capsulotomy. However, Shani *et al.* could not find any elevation of IOP in their study and postulated that healthy pseudophakic eyes do not generally show any elevation of IOP. Chao *et al.* in their 3-month follow-up study also did not find any persistent rise in IOP.

### Retinal Detachment

In the study, there was no case of retinal detachment. This could be due to the absence of risk factors in the cases. Retinal detachment may complicate Nd:YAG laser posterior capsulotomy in 0.08–3.6% of eyes.<sup>[27]</sup> Retrospective review of Medicare claims found the cumulative probability of retinal detachment over 36 months following cataract surgery was 1.6–1.9% in patients who had laser capsulotomy versus 0.8–1% in patients undergoing cataract surgery alone. This review could not distinguish if the same or fellow eye had cataract surgery, capsulotomy, and retinal detachment, nor could it determine the sequence.<sup>[23]</sup> Retinal detachment may occur early after the laser capsulotomy or more than a year later. Asymptomatic retinal breaks were found at a rate of 2.1% within 1 month of posterior capsulotomy in one study. Myopia, a history of retinal detachment in the other eye, younger age, and male sex are risk factors following Nd:YAG laser posterior capsulotomy.<sup>[27]</sup> In uncomplicated phacoemulsification and PCIOL implantation, a rate of retinal detachment after laser capsulotomy of 0–0.4% over 1–8 years has been reported in two series. In one of these series, no retinal detachments occurred in eyes with axial lengths under 24.0 mm. A study found no increased risk of retinal detachment after Nd:YAG laser capsulotomy in eyes that did not have a posterior capsule tear at the time of cataract surgery.<sup>[23]</sup> Numerous studies have examined the relationship between Nd:YAG laser posterior capsulotomy and development of retinal detachment. Initial studies by Aron-Rosa *et al.*<sup>[26]</sup> claimed an incidence of 0.08%. Steinert *et al.*<sup>[28]</sup> reported 0.89%.



### CME

CME develops in 0.55–2.5% of eyes following Nd:YAG laser posterior capsulotomy. CME may occur between 3 weeks and 11 months after the capsulotomy. Incidence of new CME is low following laser capsulotomy, although some patients may acquire CME at a later date.<sup>[27]</sup> Risk of CME could be lowered by a longer interval between extracapsular cataract extraction and laser capsulotomy, although other studies have not confirmed this. Treatment of CME following Nd:YAG laser posterior capsulotomy is identical to its treatment following cataract extraction.<sup>[23]</sup> The development of CME after Nd:YAG laser posterior capsulotomy has been demonstrated in many studies. The main diagnostic tools are evaluation with 78 D lens and fundus fluorescein angiography. In the study, there was no case identified having CME. The incidence of CME according to Winslow and Taylor was 0.55% and they attributed this occurrence to vitreous instability secondary to hyaluronic acid and prostaglandin diffusion through the compromised posterior capsule. According to Alhert *et al.*, the incidence of CME was 5.4%. Jampol hypothesized that UV-A light may generate free radicals, facilitating prostaglandin production, and including inflammation and ultimately CME.

### IOL Damage

Pitting of IOLs occurs in 15–33% of eyes during Nd:YAG laser posterior capsulotomy. Pitting is usually not visually significant, although rarely the damage may cause sufficient glare and image degradation that the damaged IOL must be explanted.<sup>[29]</sup> The type and extent of lens damage depend on the material used in the IOL. Glass IOLs may be fractured by the Nd:YAG laser. PMMA IOLs sustain cracks and central defects with radiating fractures.<sup>[30]</sup> Molded PMMA IOLs are more easily damaged than higher molecular weight lathe-cut lenses.<sup>[31]</sup> Damage to silicone lenses is characterized by blistered lesions and localized pits surrounded by multiple tiny pits.<sup>[32]</sup> The damage threshold is lowest for silicone, intermediate for PMMA, and highest for acrylic materials.<sup>[25]</sup> Frequency of damage depends on IOL style.<sup>[27]</sup> IOLs designed with a ridge separating the posterior capsule from the IOL sustain less damage than lenses with a convex posterior surface and close apposition between the posterior chamber IOL and the posterior capsule.<sup>[33]</sup>

### Endophthalmitis

*Propionibacterium acnes* endophthalmitis has been reported following Nd:YAG laser posterior capsulotomy. Patients have decreased vision caused by PCO and an otherwise quiet eye. Following laser capsulotomy, the eyes developed significant uveitis and loss of vision. The capsulotomy is presumed to have created opportunity for organisms within the capsule to reach the vitreous and develop into endophthalmitis.<sup>[34]</sup>

### Other Complications

Corneal complications such as corneal abrasions and exacerbation of epithelial dystrophies have not been noted in the study. Pitting of IOL is seen in 6 cases due to uncooperativeness of patients. Bleeding from iris occurred in 4 cases. These cases have dense synechiae. However, the bleeding was mild and it got subsided within 1 week in all 4 cases. Other rare complications such as corneal stromal scarring, macular holes, and endophthalmitis did not occur in the study.

### VA Improvement After Nd:YAG Laser Capsulotomy

In the study, 97% cases had shown improvement in VA. VA improved to 6/6 in 16 cases, 6/9 in 36 cases, 6/12 in 16 cases, 6/18 in 10 cases, 6/24 in 8 cases, 6/36 in 7 cases, and 6/60 in 4 cases. 3 cases were lost for follow-up. Due to high astigmatism most of the cases could not be improved to 6/6.

### Late Post-operative Complications

In the follow-up period of 1 week, 4 weeks, 12 weeks, and 24 weeks cases were examined for complications such as CME, retinal detachment, and chronic glaucoma. None of the cases presented with CME, retinal detachment, and chronic angle glaucoma.

## CONCLUSIONS

Improvement in VA with Nd:YAG laser capsulotomy is excellent. Complications with Nd:YAG laser capsulotomy are minimal and transient. Careful follow-up with Nd:YAG laser capsulotomy is important and topical timolol maleate 0.5% drops after capsulotomy prevents spikes of IOP which may occur in some case. Oral acetazolamide along with topical timolol can be used in patients who show rise of IOP uncontrollable with topical timolol alone. Proper selection of case is important. Pitting of IOL may occur in uncooperative patients. Nd:YAG laser capsulotomy should be done with caution in patients with increase in axial length, peripheral degenerations, and retinal detachment in other eyes as these patients are at increased risk of retinal detachment. Nd:YAG laser capsulotomy should be postponed by at least 3 months after cataract surgery to decrease the incidence of iritis. Nd:YAG laser capsulotomy is a safe method of restoring vision in patients with PCO. The results of Nd:YAG laser capsulotomy were comparable to those reported in literature. Rise in IOP is the most common complication after the Nd:YAG laser capsulotomy, which is followed by iritis, vitritis, pitting of IOL, and hyphema.

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# An Analysis of Impedance Audiometry in Geriatric Patients with Hearing Loss - A Hospital-based Study

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## Abstract

**Background:** The causes of hearing loss (HL) in geriatric patients are many and in view of the ever-changing theories of mechanism of hearing require thorough clinical and scientific study to understand the same.

**Aim of the Study:** This study aims to analyze the results of impedance audiometry in geriatric patients to understand the organic changes in the ear related to aging.

**Materials and Methods:** A cross-sectional, prospective, and comparative study of geriatric patients with HL managed at ENT OPD. Initially, a structured questionnaire was used to gather the clinical information followed by audiological evaluation. Intergroup differences of the study group were performed using clinicoaudiometric findings such as middle ear pressures, acoustic reflexes, and tympanograms.

**Observations and Results:** A total of 90 geriatric patients with HL were included; 53 (58.88%) were males and 37 (41.11%) were females with male-to-female ratio 1:1.43; age group of 61–89 years with a mean age of  $72.35 \pm 4.26$  years. Tympanometry showed conductive deafness in 46/90 patients (51.11%); these patients showed abnormal tympanograms; Type B (09), C (16), “As” (14), and “Ad” (07). Pure tone average (PTA) above 20 dB was observed in 66/90 patients (73.33%). PTA values of more than 20 dB were observed in 66/90 patients. Absent acoustic reflexes were seen in 29/90 patients (32.22%).

**Conclusions:** Impedance audiometry abnormalities were demonstrated in few of the geriatric patients with HL which were significantly associated with parameters related to organic changes of aging. It is necessary that elderly patients with HL should have both their inner and middle ear function assessed with suitable gadgets, to manage them optimally.

**Key words:** Audiometry, Conductive, Geriatric, Hearing loss, Sensorineural and mixed hearing loss

## INTRODUCTION

The theories of hearing mechanism explain complex and concurrent interplay of several parts of the ear resulting in conduction of sound waves from the environment through the external auditory canal; vibrating the tympanic membrane; transformer mechanism of the middle ear ossicles, and finally, the piezoelectric effect of hair cells of cochlea converting the mechanical energy to electrical

energy. The electrical waves so generated are transmitted to the auditory cortex for final analysis and appreciation. Organic changes occurring in the body due to aging process also occur in the ear resulting in hearing loss (HL) otherwise called as “presbycusis.” HL is considered as the most common aging process affecting the neuronal systems in the body.<sup>[1]</sup> Few studies have suggested that sensorineural HL accounts to one-third of the total HL causes in the geriatric age groups (61–70 years).<sup>[2]</sup> In excess of 80% of geriatric aged beyond 85 years has clinically obvious difficulty understanding the speech and following conversations in the presence of background noise.<sup>[2,3]</sup> The hearing threshold increases by 1 dB/year on an average for patients aged 60 years and above.<sup>[4]</sup> They also develop a tendency to further deterioration with increasing age.<sup>[4]</sup> The pure tone averages (PTA - average of minimum threshold hearing at 500, 1000, and 11,500 KHz) studied in one

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scientific paper was shown to be  $\geq 25$  dB in 35% of the patients aged 60 years and may increase further to 50% in the age group between 70 and 80 years.<sup>[5]</sup> The prevalence of HL in geriatric patients varies in different location of the world, but it was established that HL increases certainly after 60 years.<sup>[6]</sup> The HL in geriatric patients is in similar lines such as conductive, sensory, neural, or mixed types. The organic changes that occur in tympanic membrane, ligaments of the ossicle, ossicles proper and inter ossicular joints, hair cells, and neurons of the auditory nerve are well recorded.<sup>[7]</sup> In the cochlea, they include loss of sensory hair cells of the cochlea consequent on generalized degenerative processes, dysfunction of the stria vascularis (the main blood supply to the organ of Corti), and degeneration of the neurons of the cochlear nerve or its central connections.<sup>[7]</sup> In the external ear, wax impaction in the external auditory meatus has been reported to be disproportionately more common in the elderly patients than in other groups of patients, causing conductive HL; morphological changes in the head of the mandible and angle of mandible (more obtuse) leads to distortion of the external auditory canal is explained the cause of wax impaction resulting in conductive deafness;<sup>[8]</sup> the degenerative changes in epithelium of the skin lining the external auditory canal without an accompanying reduction in the rate of wax production may another explanation given. Few authors have observed changes in the dynamic characteristics of the middle ear contents, especially the mucosal folds, ligaments, and ossicles proper affecting the middle ear transformer mechanism.<sup>[9,10]</sup> These observations would have been possible from different types of instruments applied in measuring the hearing acuity recently.<sup>[11,12]</sup> In the present study, as a hospital-based survey of HL in geriatric patient's audiological evaluation was done using pure tone audiometry, impedance audiometry, acoustic reflexes, and tympanograms.

### Aim of the Study

This study aims to analyze the results of impedance audiometry in geriatric patients to understand the organic changes in the ear related to aging.

### Study Period

The period of study was from July 2015 to June 2017.

### Institute of Study

The study was conducted at Kurnool General Hospital Attached to Kurnool Medical College, Kurnool, Andhra Pradesh.

### MATERIALS AND METHODS

The present study is a hospital-based cross-sectional, prospective, and comparative study conducted on 90 geriatric patients (aged above 60–90 years) attending the

ENT OPD for complaints of HL lasting for more than 6 months.

### Inclusion Criteria

1. Patients aged above 60 years are included.
2. Patients with HL for more than 6 months duration are included.

### Exclusion Criteria

1. Patients below 60 years were not included.
2. Patients who have undergone any type of ear surgery previously were excluded.
3. Patients with middle ear diseases were excluded.
4. Patients on injection streptomycin previously were excluded.
5. Patients with complaints of vertigo were excluded.
6. Patients with diabetes mellitus and women with a history of eclampsia were excluded.

Institutional Ethical Committee clearance certificate was obtained. Ethical Committee approved consent form and questionnaire were only used in the study. The general nature, significance, and requirements of the patients, including the fact that declining to participate in the study would not affect treatment, were explained to the patients. The questionnaires were prepared to have three parts; Part A: Questions related to sociodemographic information, Part B: Medical complaints related to hearing, history of present illness HL, duration of hearing impairment, and present or previous ear surgeries; and Part C was otoscopy findings and records of the audiometric profiles of the patients, which included the PTA, tympanometry, and acoustic reflexes. The acoustic reflex thresholds were tested with contralateral stapedial reflexes for frequencies of 500, 1000, 2000, and 4000 Hz; the thresholds were considered as normal when elicited between 75 and 110 dB HL. The tympanograms were classified according to Jerger Types A, As, Ad, B, and C; 14 with Type A considered as normal, and any other tympanogram types as abnormal, while acoustic reflexes were classified as present or absent. All the data were analyzed using standard statistical method; analyzed using Chi-square test, while continuous variables, presented as absolute values and means, were compared using Student's *t*-test. The level of statistical significance was set at  $P < 0.05$ . Data analysis was performed using [socialscistatistics.com](http://socialscistatistics.com) online.

### OBSERVATIONS AND RESULTS

A total of 90 geriatric patients were included in the present study. Among them, 48 (53.33%) were males and 42 (46.66%) were females with male-to-female ratio 1:1.43. Patients belonged to the age group of 61–89 years with a



mean age of  $72.35 \pm 4.26$  years. 61 patients (67.77%) were above 70 years of age in the study [Table 1].

Among the 90 subjects, 45 males were married and 40 females were married. The demographic data and social status are shown in Table 2.

Pure tone audiometry showed normal PTA in 09 patients (10%), 15 to 20 dB loss of hearing in 15 patients (16.66%), 20 to 30 dB loss in 18 patients (20%) and 30 to 40 dB loss in 36 patients (40%), and 1 above 40 dB loss in 10 patients (11.11%) [Table 3].

The types of tympanograms observed in this study included Type A in 44 patients (48.88%), Type B in 09 (10%), Type C in 16 (17.77%), Type As in 14 (15.55%), and Type D in 07 (7.77%) [Table 4].

In the present study, acoustic reflexes were present in 61 patients (67.77%) and absent in 29 patients (32.22%) [Table 5].

## DISCUSSION

Organic changes in all parts of the ear due to aging are mentioned in all the standard textbooks. The changes are in external auditory canal causing narrowing which is in turn due to changes in the angle of the mandible and wearing out of the head of the mandible.<sup>[8]</sup> Changes in tympanic membrane include opacification of the periphery of the membrane due to collagen deposition in the fibrous layers.<sup>[12]</sup> Age-related changes are described in the ligaments of ossicles, and the osteoporosis of the ossicles proper<sup>[8]</sup> is likely to cause conductive deafness affecting the lower frequencies. In the present study, elderly patients presenting with complaints of HL, difficulty in understanding speech, and difficulty in appreciating the fine-tuning of speech were subjected to audiological evaluation. It was observed that there were few abnormal audiometry findings in PTA, tympanometry graphs, and acoustic reflexes. Many researchers have focused on sensorineural component of HL in geriatric patients and ignored the conductive component of HL. In the present study, the audiometry values point to conductive deafness; in 46/90 patients (51.11%); these patients showed abnormal tympanograms; Type B (09), C (16), As (14), and Ad (07). PTA above 20 dB was observed in 66/90 patients (73.33%) [Table 3]. However, these observations would not conclusively ascertain whether these middle ear abnormalities were due to aging process, or mere coincidental findings. Nondahl *et al.*<sup>[13]</sup> reported a small degree of middle ear stiffening occurring over the years among older adults. An animal experiment by Doan *et al.* also found structural changes

**Table 1: The age and gender incidence of the study group (n=90)**

Age groups (years)	Male n=48	Female n=42	Total (%)
61–70	17	12	29 (32.22)
71–80	24	21	45 (50)
81–90	07	09	16 (17.77)

**Table 2: The sociodemographic data of the study group (90)**

Demographic observations	Male n=48 (%)	Female n=42 (%)
Married	45 (50)	40 (44.44)
Unmarried	03 (6.66)	02 (2.22)
Illiterate	02 (2.22)	04 (4.44)
Formal education	16 (17.77)	18 (20)
Graduates	20 (22.22)	14 (15.55)
Postgraduates	10 (11.11)	06 (6.66)
Skilled	14 (15.55)	11 (12.22)
Semi-skilled	18 (20)	10 (11.11)
Professionals	16 (17.77)	19 (21.11)

**Table 3: The PTA values in the study group (n=90)**

PTA in dB	n (%)
Normal	09 (10)
15–20	15 (16.66)
20–30	20 (20)
30–40	36 (40)
Above 40	10 (11.11)

PTA: Pure tone average

**Table 4: The types of tympanogram observed (n=90)**

Type of tympanogram	n (%)
Type A	44 (48.88)
Type B	09 (10)
Type C	16 (17.77)
Type AS	14 (15.55)
Type D	07 (7.77)

**Table 5: The incidence of acoustic reflexes present in the study (90)**

Acoustic reflexes	n (%)
Present	61 (67.77)
Absent	29 (32.22)

in the middle ear of aging mouse that was attributable to aging.<sup>[14]</sup> In the present study, there was no statistical significance between the ages of normal geriatric patients and those with abnormal tympanogram graphs and acoustic reflexes. In the present study, the acoustic reflexes were absent in 29/90 (32.22%) of the patients [Table 5]. In a study by Gaihede and Koefoed-Nielsen,<sup>[15]</sup> the comparison between compliance and middle ear

**Table 6: The correlation between PTA and impedance values in the study (n-90 )**

Age Groups	PTA		Type of Tympanogram			Acoustic reflexes		P value
	30-40 dB -36	>40dB -10	B 9	C- 16	Ad 07	+ 61	- 29	
61 to 70 Yrs	07	03	01	03	03	21	11	0.038
71 to 80 Yrs	16	05	02	09	03	19	10	0.035
81 to 90 Yrs	13	02	06	04	01	21	08	0.045

PTA: Pure tone average

pressure measured by tympanometry between normal geriatric patients (with mean age 77 years) and normal younger patients (with mean age 29 years) showed that the middle ear compliance was not influenced by variation in age. There was no association found between the gender of the patients and middle ear mechanics analogous to findings of the blue mountains hearing study in Australia.<sup>[16]</sup> The observations made in the present study related to middle ear mechanisms were comparable to the similar reports prevalence of age-related HL.<sup>[17]</sup> This would also suggest that the middle ear changes and inner ear changes due to the age-related organic aging process would have simultaneous and concurrent effect on hearing. “As” type of tympanogram was observed most frequently in China among the centenarians with HL, which may be as a result of increased stiffness (decreased compliance) of the conductive mechanism.<sup>[12]</sup> This is followed by Type “C” curve suggesting a eustachian tube abnormality among the geriatric patients.<sup>[18]</sup> Golding *et al.* concluded that sometimes abnormalities occur in the tympanic membrane and in the bony ossicles, resulting in significant middle ear functional impairment.<sup>[16]</sup> An evidence of loss of vascularization, a reduction in collagen structure, elasticity, and greater rigidity of the middle fibrous layer of tympanic membrane was demonstrated by Ruah *et al.*<sup>[12]</sup> One study by Nixon *et al.* showed PTA changes amounting to more than 15 dB losses in elderly patients.<sup>[19]</sup> In the present study, similar values were observed. The possibility of osteoarthritis of ossicular joints producing “AS” type of tympanogram may also have to be considered in the geriatric patients.<sup>[8]</sup> The pathway involved in the acoustic reflex is complex and can involve the ossicular chain, cochlea, auditory nerve, brain stem, facial nerve, and other components. The absence of acoustic reflex has been shown to effectively detect HLs exceeding 30 dB in adult subjects.<sup>[20]</sup> In the present study, the patients showing absent acoustic reflexes were having abnormal PTA values and Type B and AS type of curves of tympanograms in 29/90 patients (32.22%). The limitations of this study are the lower sensitivity of the conventional tympanometer in assessing middle ear function compared with sweep frequency middle ear analyzer. The lesser incidence of absent acoustic reflexes was not explainable even though the incidence of higher PTA values was observed in 66/90 patients. Moreover, a hospital-based study is prone to bias. Despite these limitations, the study

was able to demonstrate that the middle ear functioning of elderly patients may not be fully normal. The correlation between the pure tone audiometry findings and their corresponding impedance audiometry findings and values are tabulated in Table 6.

## CONCLUSION

Impedance audiometry abnormalities were demonstrated in few of the geriatric patients with HL which were significantly associated with parameters related to organic changes of aging. It is necessary that elderly patients with HL should have both their inner and middle ear function assessed with suitable gadgets, to manage them optimally. Community-based longitudinal studies are needed to further clarify these findings.

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# Sutureless and Glueless Amniotic Membrane Graft in Primary Pterygium Surgery

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## Abstract

**Introduction:** Amniotic membrane has a very unique property as it shares the basement membrane properties of conjunctiva. Hence, it is useful replacement for the conjunctiva in pterygium surgery.

**Objective:** The objective of the study is to see the efficacy and safety of amniotic membrane graft (AMG) in primary pterygium surgery.

**Materials and Methods:** A non-comparative interventional case study was conducted on 30 eyes of 30 patients. The main outcomes that evaluated were graft success, recurrence rate in a follow-up period of 6 months and complications.

**Results:** The mean follow-up was  $6 \pm 2$  months. Their mean age was  $37 \pm 10.28$  years and ranged from 18 to 55 years. 19 (63%) patients were males and 11 (37%) were females. The pre-operative size of pterygium ranged from 2 to 5 mm (mean 3 mm) was recorded. In 4 (13.13%) patients, graft loss was seen on the 1<sup>st</sup> post-operative day. No other graft-related complications were seen during the follow-up period of 6 months. Post-operative complications in follow-up visits were conjunctival hyperemia seen in 9 (30%) patients, 3 (10%) patients had conjunctival granuloma. The recurrence of pterygium was observed in 2 (6.66%) patients after 3<sup>rd</sup> and 6<sup>th</sup> post-operative month.

**Conclusion:** The present study thus concluded that AMG was effective and safe with no major complications and did not require creating another raw area over ocular surface with inherent complications.

**Key words:** Amniotic membrane graft, Basement membrane, Conjunctival granuloma, Cornea, Pterygium

## INTRODUCTION

A pterygium is a “wing-like” growth which is triangular in shape, fleshy, and consists of conjunctival epithelium and hypertrophied subconjunctival connective tissue that occurs nasally and or temporally in the palpebral fissure, and encroaching onto the cornea [Figure 1]. Limbal stem cell deficiency, epithelial abnormalities, and fibrovascular component have a role in the pathogenesis of pterygium, corneal invasion, and pterygium recurrence.

Treatment of choice is the surgical removal. The fact that numerous different techniques exist for the

surgical treatment of pterygium underscores the point that no single approach is universally successful. The main challenge in pterygium surgery is the prevention of recurrence. The bare sclera excision alone has high recurrence rates of 38%–88%.<sup>[1]</sup> Conjunctival autografting is today recognized by many corneal and anterior segment surgeons as the procedure of choice for pterygium surgery, in terms of its efficacy and safety and represents the “gold standard” to which other procedures may be compared. Both superior and inferior conjunctival autografts can be used.<sup>[2]</sup>

Recently, preserved human amniotic membrane has been advocated for the management of many ocular surface disorders,<sup>[3]</sup> the basement membrane component of amniotic membrane is similar in composition to the conjunctiva.<sup>[4]</sup> Amniotic membrane has anti-fibroblastic and antimicrobial activity, as it has been shown to suppress transforming growth factor-beta signaling in conjunctival and pterygium fibroblasts.

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Therefore, this study was undertaken to evaluate the amniotic membrane graft (AMG) for the management of pterygium and its complications.

### Aim and Objectives

The present study was undertaken to evaluate and assess the efficacy and safety of AMG as an adjunctive therapy after removal of primary pterygium.

The main outcome measures that were studied include graft success, recurrence rate in a follow-up period of 6 months, complications, and to analyze the data collected and compare it with international literature.

## MATERIALS AND METHODS

A total of 30 patients with primary pterygium were included in the study. In 30 patients (30 eyes), the commercially available dry AMG was attached.

A detailed medical and ophthalmic history was recorded. Uncorrected and best-corrected visual acuity was recorded with Snellen chart. Slit lamp examination with special reference to size and extent of pterygium was recorded. Conjunctival swabs were taken to rule out infection. Hematological examination such as hemoglobin, bleeding time, and clotting time was performed for each patient. All patients were given explanation of the procedure, and informed consent was obtained from all.

### Surgical Procedure

Peribulbar anesthesia was used with 50:50 mixtures of 5 ml of 2% lignocaine and 0.5% of bupivacaine with 150 units/ml of hyaluronidase injection.

Preparing and draping the selected eye in normal sterile fashion in over time. An eye speculum was inserted and eyelids retracted. The eye was irrigated thoroughly with balanced saline solution. A 0.5 ml of 2% xylocaine was injected just underneath the body of pterygium about 2–3 mm away from limbus with a 26 gauge needle.

A small incision was given in the conjunctiva just medial to the head of pterygium after engaging with fixation forceps. The conjunctiva was progressively dissected off from the body of pterygium using Westcott scissors. The pterygium was removed from the cornea by avulsion. Only the thickened portions of conjunctiva and the immediate adjacent and subjacent Tenon's capsule showing tortuous vasculature were excised. Where, possible, hemostasis was allowed to occur spontaneously without the use of cautery.

The size of defect was measured with the calipers.

The commercially available dry amniotic membrane was taken. The size of graft was determined using calipers on the 3 cm × 3 cm amniotic membrane piece. The patient's bare scleral area was then covered with AMG, which was oriented with basement membrane side up. The grafts were left untouched for 5 min so that grafts get adhered to its bed and were patched and bandaged for 24 h.

The patients were followed up postoperatively after 24 h [Figure 2], 2 weeks, and at 3 months, 6 months.

A slit lamp examination was performed at every visit to monitor graft integrity and development of complications such as corneal defects, symblepharon, giant papillary conjunctivitis, and granuloma formation.

## RESULTS

The characteristics of patients are shown in Table 1. Averaged follow-up time was 6 months. 4 patients (13%) had graft loss on the 1<sup>st</sup> post-operative day. 3 patients (10%) had graft edema that subsided after 1<sup>st</sup> post-operative week shown in Table 2. 2 cases (7%) developed recurrence of pterygium which occurred at 3<sup>rd</sup> and 6<sup>th</sup> post-operative month, respectively, were shown in Table 3.

9 (30%) patients had conjunctival hyperemia which subsided by the end of the 1<sup>st</sup> post-operative week. There

**Table 1: Pre-operative characteristics of eyes with primary pterygium in the patients**

Characteristics	Patients
Number of eyes	30
Age in years (Mean±SD)	37±10.28
Gender	
Male	19
Female	11
Eye involved	
Right	18
Left	12
Site of pterygium	
Nasal	30
Temporal	0
Pre-operative size of pterygium	
Mean±SD	3±1.2

SD: Standard deviation

**Table 2: 1<sup>st</sup> post-operative day**

Complications	Number of patients AMG (%)
Graft loss	4/30 (13)
Graft retraction	0/30 (0)
Graft edema	3/30 (10)
Sub-graft hematoma	0/30 (0)
Others	0/30 (0)

AMG: Amniotic membrane graft

were three cases of conjunctival granuloma which were treated surgically. No other complications were seen in patients.

## DISCUSSION

The high rate of recurrence after excision of pterygium has been the main obstacle in its successful treatment. However, in its endeavor to minimize recurrence, different techniques with different adjuncts were tried by various authors from time to time [Table 4]. Although many surgical modalities have been proposed to treat pterygium, none of them is yet an ideal one to accomplish the desired result. Adjunctive treatments in the form of beta-irradiation, argon-laser photocoagulation, and thiopeta were introduced to reduce

the rate of recurrence, but none of them were without complications such as sclera thinning, radiation induce cataract, and ulceration.<sup>[5]</sup> The use of Mitomycin C (MMC) eye drops has also been used to prevent the recurrence of pterygium after its excision, but the use of MMC is also associated with complications such as corneoscleral melting, cataract, uveitis, symblepharon, and secondary glaucoma.

The bare sclera technique used for excision of pterygium was also associated with high recurrence rate.

Kenyon *et al.*<sup>[6]</sup> popularized the conjunctival autograft transplantation technique. It reestablishes the barrier functions of limbus, and hence, significantly lowers the recurrence rate.

Amniotic membrane promotes conjunctival epithelial wound healing and suppresses activation and extracellular matrix production by pterygium fibroblasts and inhibits pterygium recurrence. When compared with conjunctival limbal autograft transplantation recurrences rate is higher for AMG. The chemotherapeutic agents like 5-fluorouracil and other medications like bevacizumab are also currently being investigated.<sup>[7]</sup>

The use of topical mitomycin C in combination with amniotic membrane transplantation (AMT) has also been shown to lower the rate of recurrence in pterygium. However, another study did not show the same results.<sup>[19]</sup>

**Table 3: Post-operative complications in follow-up visits in both the groups**

Complications	Patients (%)
Conjunctival hyperemia	9/30 (30)
Corneal defects	0/30 (0)
Pyogenic granuloma	0/30 (0)
Symblepharon	0/30 (0)
Conjunctival granuloma	3/30 (10)
Recurrence	2/30 (7)
Increased IOP	0/30 (0)
Others	0/30 (0)

IOP: Intraocular pressure

**Table 4: Recurrence rates recorded by various authors**

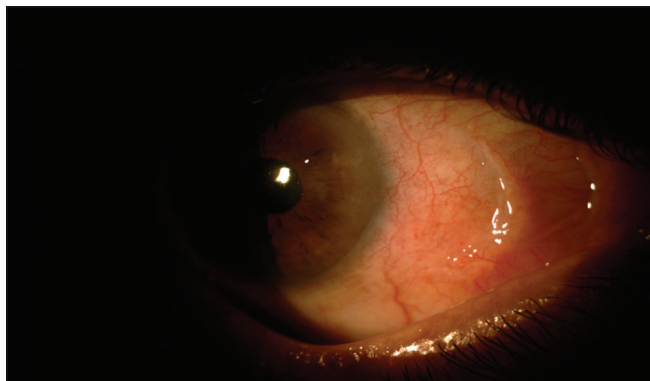
The recurrence rates recorded by various authors are as

Study	Surgical technique	Recurrence rate (%)
Prajna <i>et al.</i> <sup>[8]</sup>	Conjunctival autograft	0
	AMG	25.8
Noureddin and Yeung <sup>[9]</sup>	AMG	3.8
	Conjunctival autograft	5.4
	Mitomycin C	3.7
Katircioglu <i>et al.</i> <sup>[10]</sup>	Amniotic membrane-mitomycin C	8
	Conjunctival autograft-MMC	13.3
Patil and Melmane <sup>[11]</sup>	Group A (conjunctival autograft)	4
	Group B (AMG)	4
Kurna <i>et al.</i> <sup>[12]</sup>	Limbal sliding flap transplantation	7.1
	Primary closing	56
	AMG	27.3
Okoye <i>et al.</i> <sup>[13]</sup>	AMG	6
Arain <i>et al.</i> <sup>[14]</sup>	Bare sclera technique	37.5
	AMT	12.9
Li <i>et al.</i> <sup>[15]</sup>	C CLAT	0.03
	AMG	0.22
Chen <i>et al.</i> <sup>[16]</sup>	Limbal autograft group	22.5
	AMG group	22.2
Khan <i>et al.</i> <sup>[17]</sup>	Bare sclera	36.6
	Conjunctival autograft	8.8
	AMG	7.4
Ozer <i>et al.</i> <sup>[18]</sup>	Bare sclera	39.58
	Conjunctival autograft	14.29
	AMG	23.08
Present study	AMG	7

AMT: Amniotic membrane transplantation, AMG: Amniotic membrane graft, MMC: Mitomycin C, CLAT: Conjunctival limbal autograft transplantation



**Figure 1: Nasal pterygium**



**Figure 2: Amniotic membrane graft on post-operative day 1**

In another study, Kucukerdonmez *et al.*<sup>[20]</sup> compared the cosmetic outcome of using AMT following pterygium excision with either fibrin glue or vicryl sutures and found that there was no difference in cosmetic outcome. No major complications were seen with AMT. In one study by Ma,<sup>[21]</sup> no major complications were noted in 80 eyes which were treated with AMT.

## CONCLUSION

The present study thus concluded that amniotic membrane graft was effective and safe with no major complications and did not require creating another raw area over ocular surface with inherent complications. AMG may be the preferred procedure for primary pterygium and is especially suited for large sized pterygium, eyes with diseases of conjunctival involvement, bilateral pterygium, and glaucoma patients who underwent filtration operations.

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# A Study on Biochemical Predictors of Left Ventricular Diastolic Dysfunction in Patients with Type 2 Diabetes Mellitus

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## Abstract

**Background:** The prevalence of coronary artery disease (CAD) is nearly 3 times more common in diabetes mellitus (DM) patients than in non-DM patients. Impaired glucose tolerance can be considered as a major risk factor of CAD. Hyperinsulinemia is one of the conditions of abnormal glucose metabolism significantly affects atherosclerosis development.

**Aim of the Study:** This study aims to determine the risk factors in the onset of the left ventricular diastolic dysfunction (LVDD) within 4 years of follow-up of patients with Type 2 DM (T2DM).

**Materials and Methods:** A total of 48 patients with T2DM were subjected to baseline fasting blood samples for fasting blood sugar (FBS), high sensitive C-reactive protein (hsCRP), hemoglobin A1c (HbA1c), and triglycerides (TG) levels. Resting transthoracic two-dimensional echocardiography and Doppler imaging to assess LVDD, left ventricular myocardial index (LVMI), and left ventricular mass at baseline and annually for 24 months was done in all the patients. Diastolic function was categorized based on mitral inflow and Doppler tissue imaging parameters. All the data were analyzed using standard statistical methods.

**Observations and Results:** Among 48 patients with T2DM aged 45–70 years, the mean age was  $56.34 \pm 35$ ; 26 males and 22 females with a male-to-female ratio of 1.8:1. Baseline body mass index was  $28.97 \pm 3.60$ , mean FBS was  $128 \pm 6.21$ , and mean HbA1c was  $7.5 \pm 1.21$ . The mean duration of T2DM in the patients was  $7.23 \pm 3.10$  years.

**Conclusions:** The baseline hsCRP and TG levels can predict the presence of LVDD within 24 months in Type 2 diabetes patients with previously normal systolic and diastolic cardiac function, whereas angiotensin receptor blocker therapy might have a protective role.

**Key words:** Diabetes mellitus, Left ventricular diastolic dysfunction, Coronary artery disease, Type 2 diabetes

## INTRODUCTION

Review of literature shows that Type 2 diabetes mellitus (T2DM) patients are at a risk to develop cardiomyopathy (diabetic cardiomyopathy) clinically characterized by the left ventricular diastolic dysfunction (LVDD).<sup>[1,2]</sup> Even in patients with good glycemic control, the incidence of LVDD is 47%.<sup>[3]</sup> High levels of high-sensitivity C-reactive protein (hsCRP) have been found to be associated with subclinical LVDD in

patients with cardiovascular (CV) risk factors.<sup>[4]</sup> Therefore, the aim of the present study was to determine possible risk factors that could predict the new onset of LVDD within 48 months of follow-up in a T2DM patient cohort. DM is the most common cause of CAD in young people. Similarly, nearly, 50% of patients with recently diagnosed as T2DM have CAD at the time that DM is diagnosed.<sup>[5]</sup> Developing acute myocardial infarction (AMI) in patients with T2DM is 50% and 150% greater in men and women with T2DM, respectively.<sup>[6]</sup> The prevalence of sudden death due to CAD is 150% and 300% more frequent in men and women with DM, respectively, than in the non-diabetic population.<sup>[7]</sup> The frequency of developing AMI and silent ischemia is more common with a greater morbidity and mortality; after AMI in these patients, there would be slower reperfusion speeds following thrombolytic treatment; a larger number of vessels involved; more diffuse distribution and more

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severe narrowing of the left coronary artery; and a higher rate of restenosis after coronary angioplasty.<sup>[8]</sup> In spite of this evidence, it is noteworthy that less than one-third of diabetic patients are aware of their greater cardiovascular risk.<sup>[9]</sup> In this context, the present study was conducted to determine the risk factors in the onset of LVDD within 4 years of follow-up of patients with T2DM.

### Aim of the Study

This study aims to determine the risk factors in the onset of LVDD within 4 years of follow-up of patients with T2DM.

### Study Period

The study period was from July 2015 to June 2017.

### Institute of Study

The study was conducted at Kannur Medical College, Anjarakandy, Kannur, Kerala.

## MATERIALS AND METHODS

Totally, 48 patients were included in the study. They were aged between 45 and 70 years. There were 26 males and 22 female patients. They were diagnosed as T2DM and attending the Department of Medicine of a tertiary teaching hospital. An ethical committee clearance was obtained before the commencement of the study. An Ethical Committee cleared consent letter was used in the study.

### Inclusions Criteria

1. Patients with diagnosed T2DM and aged between 45 and 70 years were included.
2. Patients with no history of Angina, AMI were included.

### Exclusion Criteria

1. Patients with coronary artery disease, inflammatory states, and active malignancy were excluded.

All the patients were elicited of clinical history, collection of demographic data. All the patients were estimated of body mass index (BMI). The laboratory investigations included were fasting blood samples for fasting blood sugar (FBS), hsCRP, hemoglobin A1c (HbA1c), and triglycerides (TG) levels at the baseline visit. Resting transthoracic two-dimensional echocardiography and Doppler imaging to assess LVDD, left ventricular myocardial index (LVMI), and left ventricular mass at baseline and annually for 24 months was done in all the patients. The LV ejection fraction was estimated using the Simpson biplane method. The E- and A-wave peak velocities and deceleration time (DT) were measured using the mitral inflow profile. The E' velocity from the septal and lateral mitral valve annulus and the mean value were determined, and the respective E/E' ratios were derived. An E/E' septal ratio >15 was

considered to be indicative of elevated LV filling pressure. Diastolic function was categorized based on mitral inflow and Doppler tissue imaging parameters. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

A total of 48 patients included in the present study with T2DM were aged 45–70 years with a mean age of  $56.34 \pm 35$ . There were 26 males and 22 females with a male-to-female ratio of 1.8:1. At the beginning of the study, the mean BMI was  $28.97 \pm 3.60$ , mean FBS was  $128 \pm 6.21$ , and mean HbA1c was  $7.5 \pm 1.21$ . The mean duration of T2DM in the patients was  $7.23 \pm 3.10$  years. All the patients had normal both systolic and diastolic cardiac function that were followed up for 48 months. At the beginning of the study, 21/48 (43.75%) had arterial hypertension, 23 patients (47.91%) had dyslipidemia [Table 1].

Among the 48 patients, 45 (93.75%) were taking oral antihyperglycemic agents; 44 (91.66%) were on metformin, 12 (25%) were on sulfonylurea, 9 (18.75%) were on dipeptidyl peptidase-4 (DPP-4) inhibitors, and 5 (10.41%) were on glinides [Table 2].

Among 48 patients, 14 were on angiotensin-converting enzyme (ACE) inhibitors, 08 (16.66%) were on angiotensin receptor blockers (ARBs), 3 (6.25%) were on diuretics, and 4 (8.33%) were on beta-blockers [Table 3].

At the end of the study, 2 years (24 months) 15/48 (31.25%) patients were found with diagnosis of LVDD. Univariate logistic regression analysis showed that LVDD was associated with BMI (odds ratio [OR]: 1.16, 95% confidence interval [CI]: 0.79–1.49,  $P < 0.05$ ), ARBs (OR: 0.19, 95% CI: 0.05–1.04,  $P < 0.05$ ), hsCRP (OR: 1.12, 95% CI: 1.08–1.51,  $P < 0.05$ ), TG (OR: 12.07, 95% CI: 3.01–6.04,  $P < 0.05$ ), and LVMI (OR: 1.0, 95% CI: 1.00–1.09,  $P < 0.05$ ), [Table 4].

In the present study, there was no statistically significant correlation between LVDD and sex, age, diabetes duration, history of hypertension, dyslipidemia, and TG levels. Univariate logistic regression analysis controlling for the above factors showed that LVDD was most likely associated with BMI, hsCRP, TG, and LVMI. The study also showed that the ARBs usage was negatively associated with LVDD [Table 4].

## DISCUSSION

In the present study, the Univariate analysis of laboratory values obtained shows that higher hsCRP and TG levels

**Table 1: The baseline biochemical values in the study group (n=48)**

Observation mean values	Baseline values	Values after 24 months	Mean difference 95% CI
BMI	28.97±3.60	30.11±2.80	1.16, 0.79–1.49
FBS	128±6.21	149.54±3.76	21.08, 1.01–1.54
hsCRP	2.30±0.54	3.42±0.87	1.12, 1.08–1.51
HbA1c	7.23±3.10	9.31±2.25	2.08, 1.07–2.10
Triglycerides	156±22.4	178±26.70	12.07, 3.01–6.14

CI: Confidence interval, BMI: Body mass index, FBS: Fasting blood sugar, hsCRP: High sensitive C-reactive protein, HbA1c: Hemoglobin A1c, TG: Triglycerides

**Table 2: The antidiabetic drugs used by the patients (n=48)**

Antidiabetic drugs	n (%)
Metformin	44 (91.66)
sulfonylurea	12 (25)
DPP-4	09 (18.75)
Glinides	05 (10.41)

DPP-4: Dipeptidyl peptidase-4

**Table 3: The antihypertensive drugs used by the patients (48)**

Antihypertensive drugs	n (%)
ACE inhibitors	14 (29.16)
ARBs	08 (16.66)
Diuretics	03 (06.25)
Beta-blockers	04 (08.33)

ACE: Angiotensin-converting enzyme; ARB: Angiotensin receptor blocker

**Table 4: Univariate logistic regression analysis of laboratory values and LVMI after 2 years, (n=48)**

Observation	Mean difference 95% CI	P
BMI	1.16, 0.79–1.49	0.036
ARBs	0.19, 0.05–1.04	0.721
hsCRP	1.12, 1.08–1.51	0.012
TG	12.07, 3.01–6.14	0.041
LVMI	1.00, 1.09–1.45	0.039

TG: Triglycerides, LVMI: Left ventricular myocardial index, CI: Confidence interval, BMI: Body mass index, hsCRP: High sensitive C-reactive protein, TG: Triglycerides, ARBs: Angiotensin receptor blockers

might predict the new onset of LVDD, whereas ARB therapy might have a protective role in T2DM patients. Earlier studies have shown that CRP is a marker of the left ventricular dysfunction.<sup>[10]</sup> In patients with heart failure, CRP is increased and positively associated with parameters of the left ventricular dysfunction. A previous study on diabetic complications indicated that hypertriglyceridemia was closely associated with early stages of LV systolic longitudinal myocardial dysfunction in asymptomatic DM patients with preserved left ventricular ejection fraction.<sup>[11]</sup> Elevated fasting TG are thought to be a cause of myocardial steatosis, resulting in subclinical LV systolic and diastolic dysfunction.<sup>[12]</sup> Another study demonstrated that

efficient modification of risk factor profile and, especially, of dyslipidemia, can be achieved by Proprotein convertase subtilisin/kexin Type 9 inhibitors, reducing low-density lipoprotein levels substantially and eventually reducing the incidence of cardiovascular events and ischemic left ventricle dysfunction.<sup>[13]</sup> In this study, usage of ARBs might have a protective role in the establishment of LVDD in T2DM patients. The same pattern was observed in other studies in which ARBs and ACEs inhibited ventricular fibrosis in hypertensive diastolic heart failure.<sup>[14–17]</sup> In this study, this type of protection was not found with ACE inhibitors. However, the limitation of the present study is that it is a small sample size. The favorable effects of DPP-4 inhibitors and pioglitazone on the left ventricular function were not observed in this study.

## CONCLUSIONS

The baseline hsCRP and TG levels can predict the presence of LVDD within 24 months in Type 2 diabetes patients with previously normal systolic and diastolic cardiac function, whereas ARB therapy might have a protective role. FBS and HbA1c levels did not show any predictive potential in this Type 2 diabetes patient cohort.

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# Prevalence of Epistaxis in Saudi Population

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## Abstract

**Introduction:** Epistaxis is nose bleeding that occurs due to the bursting of a nose blood vessel. It is categorized into anterior and posterior, based on where it originates. Although epistaxis is a benign medical condition sometimes, it might turn to be dramatic one and life threatening.

**Aim of the Study:** The aim of this study is to evaluate the prevalence of epistaxis among Saudi Arabia population.

**Materials and Methods:** A random sample of 1,114 participants were involved in the study with the age range of 1–>60 years. 549 were epistaxis patient, and 565 were controlled. All required information of the participants was collected on a structured questionnaire that involved several sections covering sociodemographic data, the use of anticoagulants, and the presence of other medical condition accompanied by the occurrence of epistaxis.

**Results:** Our study showed that 49% of the participants were epistaxis patients. Of the involved patients, 61.2% were males which indicate that the prevalence of epistaxis in males is higher than the female patients.

**Conclusion:** The true prevalence of epistaxis in Saudi Arabia is not precisely known because most episodes are self-limited and thus are not reported. When medical attention is needed, it is usually because of either the recurrent or severe nature of the problem.

**Key words:** Epistaxis, Prevalence, Saudi population

## INTRODUCTION

Epistaxis means bleeding from the nostril, nasal cavity, or nasopharynx. It occurs due to the bursting of a blood vessel in the nose. Although epistaxis in most cases is relatively minor and usually manageable at home, sometimes, it can be dramatic and can be a life-threatening problem.

The nasal blood supply comes from both internal and external carotid artery systems. The external carotid provides arterial flow through the facial and internal maxillary artery. The internal carotid artery supplies the nose through the terminal branches of the ophthalmic artery and the anterior and posterior ethmoid arteries. Two

anastomotic areas within the nose often provide a source of epistaxis.<sup>[1]</sup>

Epistaxis is categorized based on where it originates and is described as either anterior (originating from the front of the nose) or posterior (originating from the back of the nose).<sup>[1]</sup>

- Anterior epistaxis makes up most severe, non-traumatic nosebleeds. The bleeding usually arises from a blood vessel on the nasal septum, where a network of vessels converge (Kiesselbach plexus). Anterior nosebleeds are usually easy to control, either at home or by a healthcare practitioner.
- Posterior epistaxis is much less common than anterior ones. It tends to happen more often in old people. The bleeding usually originates from an artery in the back part of the nose. This epistaxis is more complicated and usually requires admission to the hospital and management by an otolaryngologist (an ear, nose, and throat specialist).

Epistaxis can be divided into local and systemic etiologies.<sup>[2]</sup> Trauma is one of the most common local

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causes of nosebleeds. Other local causes that predispose a person to nosebleeds include exposure to warm, dry air for prolonged periods of time, nasal and sinus infections, allergic rhinitis, nasal foreign body, vigorous nose blowing, nasal surgery, deviated or perforated nasal septum, and cocaine use.<sup>[2]</sup>

The most common systemic causes of epistaxis include hypertension may contribute to bleeding, aberrations in clotting ability due to blood-thinning medications taken such as (nonsteroidal anti-inflammatory drugs or aspirin), inherited bleeding diatheses, and vascular/ cardiovascular diseases such as congestive heart failure, arteriosclerosis, liver dysfunction, vascular malformations in the nose, and nasal tumors are rare causes of nosebleeds.<sup>[1,3]</sup>

Furthermore, the most common causes of epistaxis will change as the patient ages. One constant among etiologies, though, is that epistaxis increases in frequency during winter months because of the decreased humidity along with decreased temperature inhibits nasal humidification. Therefore, nasal mucosa is subject to poor local wound healing and become more susceptible to bleeding.<sup>[4]</sup>

Treatment of epistaxis may include sitting up, lean forward, and apply pressure to the front of the bleeding nostril for 10–15 min and breathe through the mouth. Methods of treatment include decongestant nasal sprays, chemical or electric cautery (burning the vessel shut), hemostatic agents (topical therapies to stop bleeding), nasal packing, embolization (a procedure to place material within the vessel to block it off), and surgical arterial ligation (tying off the vessel). There is no single definitive treatment for the management of nosebleeds and many factors including severity of the bleeding, use of anticoagulants, and other medical conditions can play a role in which treatment is utilized.<sup>[2]</sup>

In Saudi Arabia, in summer, the weather is extremely hot causing dryness in the thin lining of the nose and increases the chances of epistaxis. As well as in winter, the weather is extremely dry, and due the decreased humidity, nose bleeding occurs. Hence, it is recommended to gently apply Vaseline or another ointment to the front of the nose with a Q-tip on a daily basis which would also help to moisturize the nose and prevent nosebleeds due to dryness and also keeping yourself hydrated in summer would help.

Our study aimed to evaluate the prevalence of epistaxis among Saudi Arabians, as well as its association with some medical conditions such as hypertension and diabetes.

## MATERIALS AND METHODS

This cross-sectional study of 1,114 participants was conducted in the kingdom of Saudi Arabia to evaluate the prevalence of epistaxis among its population. A total of random 549 patients participated in the study including both males and females aged between 1 and >60 years old. All required information was collected on a structured questionnaire that involved several sections covering sociodemographic data, the use of anticoagulants, and the presence of other medical condition accompanied by the occurrence of epistaxis.

The collected data were analyzed using SPSS version 22.0. Data were presented using frequencies, mean and standard deviation as appropriate. The respondents' data were assessed, analyzed, and compared using Chi-square. A  $P < 0.05$  was considered statistically significant.

## RESULTS

A total of 1,114 participants were enrolled in this study with the age range from 1 to more than 60 years old. Of the participants, 209 (18.7%) were in the age group of 1–20, 539 (48.3%) were representing the age group of 21–34, and 241 (21.6%) in the age group of 35–50, while 150 (13.4%) participants represent the age group of 51–60, and 23 (2%) represent those participant aged more than 60 years old. There were 753 females (67.5%) and 361 males (32.4%). Regarding marital status, 576 were single, 517 were married participants, while 21 were divorced ones [Table 1].

Among the participants, 1031 were urban residents who represent 92.5% of the sample study, while 83 were rural residents who represent only 7.4% of the whole sample study.

Considering the education level of the participants, 74.6% have high education level, while 25% were school students, and only 0.4% of the whole sample study were illiterates.

The sample study was divided into two groups: Epistaxis group with 549 (49%) patient, and 565 (51%) representing the control group as shown in Chart 1.

Regarding the epistaxis patients who represent 549 (49%) of the sample study, 328 were females (60%), and 221 were males (40%). Of the patients, 53 (9.6%) were rural residents, while 496 (90.3%) were urban residents.

As shown in Table 2, among the 549 epistaxis patients participated in our study, 328 were females which represent

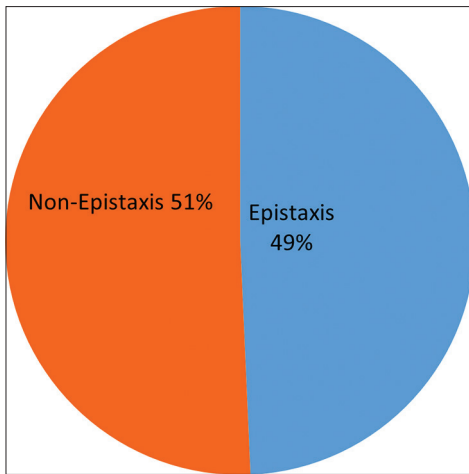


Chart 1: The prevalence of epistaxis

43.6% of the whole participating females. On the other hand, 100% of the participating males were epistaxis patients.

Regarding the age range of the epistaxis patients in the sample study, 103 (62.2%) were in the age group of 1–20, while 265 (49.2%) were in the age group of 21–34, 241 (43.6%) represented the age group of 35–50, and 49 (39.2%) represent epistaxis patients above 50 years old.

Considering residency, 53 (63.9%) were rural residents, and 496 (48.1%) of the participating were urban residents were epistaxis patients.

Taking into consideration the usage of anticoagulants, 53 of the participants do not use anticoagulants, of which 39.6% (21) are epistaxis patients, while of the 1061 participants who do not use anticoagulants, there are 528 (498%) epistaxis patients [Table 3].

Our study discussed the presence of some medical conditions that might be accompanied with epistaxis. As shown in Table 4, 565 participants were healthy, and 549 were having epistaxis either associated with a medical condition or not. 149 (27.2%) of the epistaxis patients have a chronic medical condition, 99 (18%) were having hypertension, while 450 (82%) of the epistaxis patients did not experience it. 538 (50.8%) of the epistaxis patients do not suffer from diabetes, while 27 (49.1%) were diabetics. Of the epistaxis patients, 37 (7%) were anemic, while 512 (93%) were not.

## DISCUSSION

Our study showed that 49% of the participants were epistaxis patients. Of the involved patients, 61.2% were

**Table 1: The sociodemographic characteristics of the participants**

Variables	n (%)
Age	
1–20 (years)	209 (18.8)
21–34	539 (48.4)
35–50	241 (21.6)
51–60	102 (9.2)
>60	23 (2.1)
Sex	
Female	753 (67.6)
Male	361 (32.4)
Marital status	
Single	576 (51.7)
Married	517 (46.4)
Divorced	21 (1.9)
Residence	
Rural	83 (7.5)
Urban	1031 (92.5)
Education level	
Illiterate	4 (0.4)
Primary	15 (1.3)
Intermediate	30 (2.7)
Secondary	234 (21.0)
University	793 (71.2)
Postgraduate	38 (3.4)

**Table 2: Comparing sociodemographic characteristics of epistaxis patients to the whole sample study**

Variables	Prevalence rate n (%)	X <sup>2</sup>	P
Age			
1–20 years (209)	130 (62.2)	22.19	<0.001
21–34 (539)	265 (49.2)		
35–50 (241)	105 (43.6)		
51–60 (102)	40 (39.2)		
>60 (23)	9 (39.1)		
Sex			
Females (753)	328 (43.6)	30.4	<0.001
Males (221)	221 (61.2)		
Residence			
Rural (83)	53 (63.9)	7.621	0.006
Urban (1031)	496 (48.1)		
Marital status			
Single (576)	315 (54.7)	14.198	0.001
Married (517)	226 (43.7)		
Divorced (21)	8 (38.1)		
Education level			
Illiterate (4)	4 (100.0)	17.916	0.003
Primary (15)	14 (93.3)		
Intermediate (30)	16 (53.3)		
Secondary (234)	115 (49.1)		
University (793)	378 (47.7)		
Postgraduate (38)	22 (57.9)		

males which indicate that the prevalence of epistaxis in males is higher than the female patients, and this was similar to results of another study done in internally displaced persons of North Waziristan Agency.<sup>[5]</sup>

**Table 3: The relation between epistaxis and the usage of anticoagulants**

Prevalence cases <i>n</i> =549 (%)	549(%)	<i>P</i>
Anticoagulant use		
Yes (53)	21 (39.6)	0.150
No (1061)	528 (49.8)	

**Table 4: The presence of some medical conditions that might be accompanied with epistaxis**

Medical condition	Yes/no	Having epistaxis 549 (%)	Free cases 565 (%)	<i>P</i>
Having chronic conditions	No	400 (72.8)	300 (53)	<0.0001
	Yes	149 (27.2)	265 (47)	
Hypertension	No	450 (82)	523 (92.5)	<0.001
	Yes	99 (18)	42 (7.5)	
Diabetes	No	538 (97.9)	521 (49.2)	0.804
	Yes	27 (2.1)	28 (50.9)	
Anemia	No	512 (93)	450 (79.6)	<0.0001
	Yes	37 (7)	115 (20.4)	

We also found no definite relationship between epistaxis and hypertension, and this was also confirmed in a study done in Saudi Arabia.<sup>[6]</sup> However, our results were in contrast with the results of Herkner *et al.* who found that patients with epistaxis have a higher blood pressure compared to that of a control group.<sup>[7]</sup> Also, Isezuo *et al.* found an association between epistaxis and hypertension.<sup>[8]</sup>

Our study indicates that only 7% of the involved epistaxis patients are suffering from anemia, which indicates that there is no correlation between being an epistaxis patient and having anemia. It also found that there is no association

between epistaxis and being diabetic, as only 2.1% among all involved epistaxis patients were diabetics.

## CONCLUSION

The true prevalence of epistaxis is not known because most episodes are self-limited and thus are not reported. When medical attention is needed, it is usually because of either the recurrent or severe nature of the problem. In our study, we assessed that the prevalence of epistaxis among Saudi Arabia population was 49% of the Saudis experienced epistaxis. Epistaxis in Saudis was not found to be associated with hypertension, anemia, or diabetes. In most cases, epistaxis is a benign medical condition, but sometimes it can be a critical medical condition.

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# Cone-beam Computed Tomography in Dentistry Students' and Interns' Perspective in Abha, Saudi Arabia

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## Abstract

**Objective:** The objective of the study was to assess the perspective of dental students and interns towards various aspects of cone-beam computed tomography (CBCT).

**Materials and Methods:** A cross-sectional study was conducted among the 5<sup>th</sup> year students, final year students, and interns of College of Dentistry, King Khalid University, Abha. A convenient sample of 380 students was taken for the study. A valid, reliable slightly modified questionnaire having 11-items was used. The two sections of the questionnaire consisted of questions related to demographic data such as gender and academic level in the first and questions related to CBCT in the second section. Students who were aware of CTBT use in dentistry were included in the study whereas those unaware of its use were excluded from the study.

**Results:** When subjects were asked whether they were aware of CBCT use specifically for dentistry; 68% were aware while 32% did not know about it. The findings of our study showed that 49.48%, 58.7%, and 80% of the 5<sup>th</sup> year, final year students, and interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT. Majority of the study subjects would choose CBCT in procedures such as implants, extraction of impacted teeth, evaluation of patient's cysts/tumors, and orthodontic assessment. On comparing the responses of the three groups, a statistically significant difference was found.

**Conclusions:** Although a majority of students and interns were aware of the use of CBCT in dentistry, still 32% were unaware about it. CBCT is a potential imaging modality to bring a new era in the world of imaging science. It has many advantages over medical CT as it overcomes many limitations of the same.

**Key words:** Advantage, Cone-beam computed tomography, Dental students, Imaging

## INTRODUCTION

In dentistry, radiographs have been availed of as an important diagnostic tool to detect various oral diseases.<sup>[1]</sup> Although intraoral periapical radiographs detect the pathologies of hard and soft oral tissues, the gross deficiency remains with these radiographs in the sense that

they do not differentiate between cysts, tumors, abscesses, etc., which has been made possible by the application of computed tomography (CT).<sup>[2]</sup> It (CT) has been developed long back in 1967 by Sir Godfrey Hounsfield, and since then, it has undergone significant advances.<sup>[3]</sup> Cone-beam CT (CBCT) is relatively new technology of digital dentistry that gives three-dimensional images of teeth and jaws. The method of gathering data in CBCT makes it quite different from CT, wherein rows of detectors are used, whereas in case of CBCT the whole section of patient is exposed over one detector from which the data then generates the individual slice images. The data of area of interest are obtained through a single rotation of the conical X-ray beam and reciprocal image receptor, by back-projection reconstructed tomography of CBCT scanners.<sup>[4]</sup>

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There is a considerable increase in practical use of CBCT in various fields of dentistry due to its spectrum of varied functions: It is used for diagnosis and treatment plan of nerve tracing in cases of third molar extraction and is a highly useful tool in (a) implant placement, (b) maxillofacial surgeries, (c) pathologies of sinus, (d) endodontics for locating additional roots and accessory canals, (e) detecting vertical root fractures, (f) orthodontic cases, (g) orthognathic surgeries, (h) evaluating cysts, tumors, and temporomandibular joint (TMJ) disorders, and (i) forensic dentistry as well.<sup>[5-7]</sup>

The advantages of CBCT include less radiation dose, smaller space to accommodate the apparatus, rapid scan time, and multi-planner visualization of dentist's area of concern.<sup>[8,9]</sup>

However, the use of CBCT is beneficial in real sense and optimal degree only if the interpretation of its scans is done aptly and efficiently, otherwise, if wrongly interpreted by untrained professionals, it plunges us to arriving at false diagnosis or missed lesions.<sup>[10]</sup>

Since its applicability in dental clinics is increasing manifold day by day, the precisely meticulous theoretical as well as practical knowledge and wholesome awareness toward various aspects of CBCT are indispensably important to be ideally achieved by dental students; of course, it would be beneficial in turn for them throughout their professional career ahead.

With this aim in mind, a study was conducted at King Khalid University Abha, Saudi Arabia, to assess perspective of dental students and interns towards various aspects of CBCT.

## MATERIALS AND METHODS

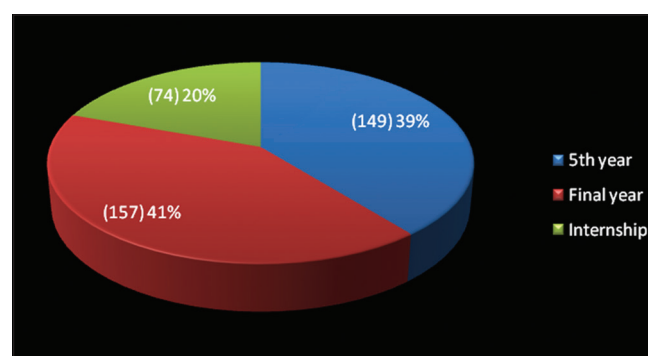
A cross-sectional study was conducted among the 5<sup>th</sup> year students, final year students, and interns of College of Dentistry, King Khalid University, Abha. Before the conduct of the study, Ethical Approval was taken from Scientific Research Committee, King Khalid University. All students of the 5<sup>th</sup> year, final year, and interns of bachelor dental surgery program who were willing to participate were included in the study. A convenient sample of 380 students was taken for the study. A valid, reliable, slightly modified questionnaire (Appendix 1) having 11 items was taken from the previous study conducted by Kamburoglu *et al.*<sup>[11]</sup> after taking researcher's permission. The two sections of the questionnaire consisted of questions related to demographic data such as gender and academic level in the first and questions related to CBCT in the second section. Students who were aware of CBCT use in dentistry were included in the study, whereas those unaware of its use were excluded from the study.

The confidentiality of the responses was assured to the participants. The duly filled questionnaires were collected on the same day so that students do not take the help from experts in the field of radiology, which would otherwise influence their responses resulting in bias.

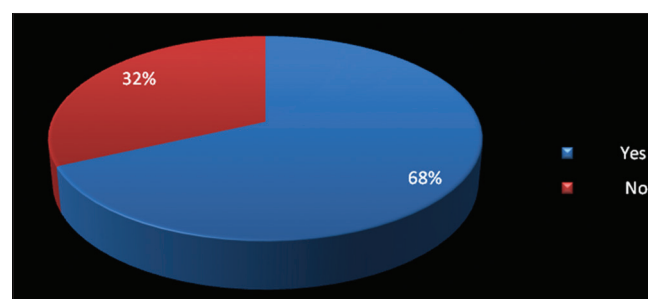
The data, thus obtained were put to statistical analysis using SPSS version 19. Descriptive statistics for frequency and percentages were done. The comparison of responses between dental students and interns was done using Chi-square test;  $P \leq 0.05$ .

## RESULTS

Out of the total 380 study participants; 149 were studying in the 5<sup>th</sup> year, 157 students belonged to final year, and 74 were doing internship [Figure 1]. 251 were male students and 129 were female subjects. When subjects were asked whether they have heard about CBCT used specifically for dentistry; 68% had heard about it while 32% did not know about it [Figure 2]. The results of the present study showed that majority of the 5<sup>th</sup> year (around 50%) and final year (86.95%) dental students obtained the information regarding CBCT from the didactic lectures while the majority of interns (74.29%) gained information regarding CBCT from seminars. The responses of students (5<sup>th</sup> and final year) and interns for Q2 and Q4 are shown in Table 1.



**Figure 1: Frequency distribution of study subjects as per the academic year of bachelor of dental surgery program**



**Figure 2: Frequency distribution of subjects when asked whether they have heard of cone beam computed tomography used specifically for dentistry**

49.48%, 58.7%, and 80% of the 5<sup>th</sup> year, final year students, and interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT [Table 2]. The frequency distribution of students and interns as per their responses to Q5, Q6, and Q7 is given in Table 3. Majority of the study subjects would choose CBCT in various procedures such as implants, extraction of impacted teeth, evaluation of patient's cysts/tumors, and orthodontic assessment [Table 4].

## DISCUSSION

In the process of conducting the present study, the subjects were inquired as to whether they had heard of CBCT used specifically for dental procedures: Around 68% of them responded positively while 32% said of never having heard about it; whereas in case of the previous study

conducted by Kamburoglu *et al.*,<sup>[11]</sup> it is stated to be found that <50% of the students had heard about CBCT. The students nowadays are becoming more inquisitive about new technologies, have well-equipped clinics and hospitals and possess internet facilities to gain more updated information; these are evidently the primary reasons for majority of the students reported in the present study as being aware about CBCT.

The results of the present study show that majority of the 5<sup>th</sup> year (around 50%) and final year (86.95%) dental students obtained their information regarding CBCT from didactic lectures while the majority of interns (74.29%) reported that they gained information regarding CBCT from seminars. These findings are similar to the previous study wherein majority of students gained their knowledge about CBCT during their classes;<sup>[12]</sup> the obvious reason is that dental students are taught by the faculty in their classes

**Table 1: Frequency distribution of subjects as per responses to Q2 and Q4**

	Q2. How did you obtain information regarding CBCT?			Q4. To what extent do you think CBCT will be used in routine dental practice in the near future?			
	Didactic lectures n (%)	Seminars n (%)	Internet n (%)	In all areas of dentistry n (%)	For selected dental applications n (%)	Not commonly used in routine practice n (%)	No idea n (%)
5 <sup>th</sup> year	78 (49.48)	4 (4.12)	52 (53.60)	16 (16.49)	11 (11.34)	18 (18.55)	97 (100.0)
Final year	80 (86.95)	10 (12.5)	50 (54.34)	21 (22.82)	6 (6.52)	15 (16.34)	92 (100.0)
Interns	3 (4.29)	52 (74.29)	57 (81.43)	10 (14.28)	2 (2.86)	1 (1.43)	70 (100.0)
Chi-square statistic is 155.6585. $P \leq 0.00001$				Chi-square statistic is 22.4105. $P = 0.00102$			

CBCT: Cone beam computed tomography

**Table 2: Frequency distribution of subjects as per their responses to Q3**

Q3. According to you, which is the most important advantage of CBCT over medical CT?	n (%)		
	5 <sup>th</sup> year	Final year	Interns
Lower radiation dose	48 (49.48)	54 (58.70)	56 (80.00)
Shorter scanning time	8 (8.25)	13 (14.13)	6 (8.57)
Less expensive	6 (6.19)	8 (8.70)	1 (1.43)
Occupies less space	14 (14.43)	10 (10.87)	2 (2.86)
Easier to maintain	8 (8.25)	3 (3.26)	3 (4.29)
Image processing is easier due to the limited beam	7 (7.22)	2 (2.17)	1 (1.43)
Data reconstruction can be performed on a personal computer	6 (6.19)	2 (2.17)	1 (1.43)
Total	97 (100.0)	92 (100.0)	70 (100.0)

Chi-square statistic is 33.0.  $P \leq 0.001$ . CBCT: Cone beam computed tomography, CT: Computed tomography

**Table 3: Frequency distribution of subjects as per their responses to Q5, Q6, and Q7**

Q6. Which year of dental education should include lectures on CBCT?				Q5. Does your faculty provide adequate education regarding CBCT?		Q7. Do you think it is necessary for a dental CBCT unit to be available at your faculty?	
	Preclinical phase	Clinical phase	Internship	Yes	No	Yes	No
Students	71 (37.57)	97 (51.32)	21 (11.11)	104 (55.03)	85 (44.97)	138 (73.02)	51 (26.98)
Interns	4 (5.71)	47 (67.14)	19 (27.14)	48 (49.48)	22 (22.68)	61 (87.14)	9 (12.86)
Chi-square is 28.6967. $P \leq 0.00001$				Chi-square is 3.86. $P = 0.049$		Chi-square is 5.72. $P = 0.016$	

CBCT: Cone beam computed tomography

**Table 4: Frequency distribution of subjects as per their responses to Q9**

Q9. For what cases would you choose to use CBCT in your future clinical dental career?	n (%)		
	5 <sup>th</sup> year	Final year	Interns
Implant dentistry	14 (14.43)	12 (13.04)	1 (1.43)
Extraction of impacted teeth	18 (18.56)	2 (2.17)	1 (1.43)
Evaluation of patients with tumors or cysts	20 (20.62)	25 (27.17)	5 (7.14)
Orthodontic assessment	7 (7.22)	2 (2.17)	10 (14.29)
All of the above	35 (36.08)	51 (55.43)	53 (75.71)
No need	3 (3.09)	0 (0.00)	0 (0.00)
Total	97 (100.0)	92 (100.0)	70 (100.0)

Chi-square statistic is 61.8.  $P \leq 0.00001$ . CBCT: Cone beam computed tomography

so as to become aware of it. During internship, interns get the opportunity to read detailed information about the given topic(s) for seminar presentation, and thereby they get more acquainted to the recent advances in dental technology.

The findings of our study showed that 49.48%, 58.7%, and 80% of the 5<sup>th</sup> year, final year students, and the interns, respectively, believed that lower radiation dose was the most important advantage of using CBCT over medical CT. These results corroborated with the findings of previous research results wherein majority of students and interns offered same response insofar radiation dose is concerned.<sup>[13]</sup> It is mentioned in other previous research that CBCT is a scanning system with low dose for generating the three-dimensional images of maxilla-facial structures,<sup>[14,15]</sup> whereas CT captures large sections within no time but with high radiation dose.<sup>[4]</sup> Reports from published literature reveal that the effective dose of radiation (average range 36.9–50.3 microsievert [ $\mu\text{Sv}$ ])<sup>[16]</sup> is significantly reduced to as much low as 98% in comparison to that in case of “conventional” fan-beam CT systems (average range for mandible 1320–3324  $\mu\text{Sv}$ ; average range for maxilla 1031–1420  $\mu\text{Sv}$ ).<sup>[17]</sup> It has been well documented in previous studies that the lower radiation dose of X-rays, different image generation and reconstruction of sagittal and coronal views make it convenient to use CBCT in various dental procedures.<sup>[18,19]</sup> Moreover, in the present study, shorter scan time was considered as to be the second most important advantage of using CBCT. Shorter scan time, patient compatibility, diminished image artifact,<sup>[20,21]</sup> less expensive, and easy maintenance<sup>[22]</sup> have all been recognized as certain advantages of CBCT in previous studies, notwithstanding the fact that it bears the disadvantages of beam hardening, poor soft tissue contrast, and scatter from dental materials as well.<sup>[23]</sup>

The results of the present study depict that around 47% of the 5<sup>th</sup> year dental students, 43.48% of final year, and 31.48% of interns believed that their faculty did not provide adequate education to them about CBCT. Most

probably, the reason might be unavailability of the CBCT unit in the college, where the study was undertaken; and so imparting due to knowledge gets limited to theory only. Obviously, installation of CBCT units would make it possible for the faculty to provide better knowledge practically, in addition to its theoretical part. This finding calls for a considerate attention and action; so that students get satisfactory and useful knowledge regarding the same.

Majority of students (51.32%) and interns (67.14%) thought that the lectures on CBCT should be included in dental curriculum at the beginning of clinical phase. The findings match with those of the previous study done among dental students by Kamburoglu *et al.*<sup>[11]</sup>

Moreover, 70.10% of the 5<sup>th</sup> year students, 76.02% of final year students, and 87.14% of interns believed the CBCT units are to be necessarily made available at their faculty. Unavailability of CBCT units in the dental college makes process of understanding the functions quite difficult for the students who thus genuinely wish to have CBCT units so that the faculty can impart better teaching, and thus they (students and interns) are well acquainted with its practical know-how which could be harnessed by them appropriately in their professional carriers ahead.

The findings of the current study show that around 53.6% of the 5<sup>th</sup> year dental students would choose CBCT in their clinical practice in future while 46.39% of them would not use it in future. Such results are indicative of the dilemma about convenience and efficacy of using CBCT by students since they lack the perfect knowledge about the same. On the other hand, the majority (68.57%) of interns was of the opinion of using CBCT in their professional career which might be due to more awareness and confidence among them regarding the same.

75.71% of interns, 55.43% of final year students, and 36.08% of the 5<sup>th</sup> year students thought that CBCT could be used in all procedures such as implant dentistry, extraction of impacted teeth, and evaluation of patients with tumors or cysts and orthodontic assessment. In the previous study, most of the students believed that CBCT is intended for implant dentistry.<sup>[11]</sup> The vast scope for the use of CBCT includes surgical assessment of pathology of jaw, diagnosis of TMJ disorders,<sup>[24]</sup> evaluation of growth and development,<sup>[25]</sup> pre- and post-operative assessment of facial structures,<sup>[26]</sup> and implant planning.<sup>[27]</sup>

### Recommendations

1. This high-quality imaging technology should indispensably be adopted by dentists during their procedures.

2. Dental students should be provided with appropriate CBCT education supported by practical experience at the very formative stages of their education/training.
3. CBCT units need necessarily to be made available at all the oral radiology departments.
4. Explicit, detailed, and most updated information regarding CBCT should be included in the dental radiology curriculum.
5. This study concludes with due thrust laid on the need that Continuing Dental Education programs and workshops are imperative to be organized on a routine basis to update knowledge of the faculty members.

## CONCLUSIONS

CBCT is a potential imaging modality to bring a new era in the world of imaging science. It has many advantages over medical CT, and it overcomes many limitations of the same. In the present study, we found that due to lack of practical exposure, the dental students were not fully aware of its potential benefits and usefulness. Overall, 68% of students had heard about CBCT in dental practice; when evaluated in depth, it was found that their knowledge regarding CBCT is mostly of theoretical aspect.

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## APPENDIX 1

### 1. Questionnaire

Gender

1. Male (...)
2. Female (...)

Education level:

1. 5<sup>th</sup> year (...)
2. Final year (...)
3. Internship (...).

Q1. Have you heard of cone beam computed tomography (CBCT) used specifically for dentistry?

1. Yes (...)
2. No (...).

(The remaining questions were asked only of the subjects who responded “Yes” to Q1).

Q2. How did you obtain information regarding CBCT?

1. Didactic lectures (...)
2. Seminars (...)
3. Internet (...).

Q3. According to you which is the most important advantages of CBCT over medical CT?

1. Lower radiation dose (...)
2. Shorter scanning time (...)
3. Less expensive (...)
4. Occupies less space (...)
5. Easier to maintain (...)
6. Image processing is easier due to the limited beam (...)
7. Data reconstruction can be performed on a personal computer (...).

Q4. To what extent do you think CBCT will be used in routine dental practice in the near future?

1. In all areas of dentistry (...)
2. For selected dental applications (...)

3. It will not be commonly used in routine practice (...)
4. No idea.

Q5. Does your faculty provide adequate education regarding CBCT?

1. Yes (...)
2. No (...).

Q6. Which year of dental education should include lectures on CBCT?

1. Preclinical phase (...)
2. Clinical phase (...)
3. Internship (...).

Q7. Do you think it is necessary for a dental CBCT unit to be available at your faculty?

1. Yes (...)
2. No (...).

Q8. Would you choose to use CBCT in your future professional career?

1. Yes (...)
2. No (...).

Q9. For what cases would you choose to use CBCT in your future clinical dental career?

1. Implant Dentistry (...)
2. Extraction of impacted teeth (...)
3. Evaluation of patients with tumors or cysts (...)
4. Orthodontic assessment (...)
5. All of the above
6. No need.

# An Analytical Study on Biochemical Values in Women with First Trimester Pregnancy

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## Abstract

**Background:** Routine serum biochemical and ultrasound examinations are performed in women in the first trimester of pregnancy. In addition, antenatal diagnosis is usually based on clinical risk factors, previous placenta previa, previous cesarean delivery or uterine surgery, previous uterine curettage, advanced maternal age, and associated ultrasound findings.

**Aim of the Study:** This study aims to analyze the results of routine serum biochemical tests and ultrasound examination during the first trimester, in the diagnosis of paternal, placental, and fetal abnormalities.

**Materials and Methods:** A total of 384 women in the first trimester pregnancy with gestational age between 11 and 14 weeks biochemical and ultrasound examination. The collected was analyzed to find the abnormalities of maternal, placental, and fetal diseases.

**Observations:** 384 antenatal women of OBG department were included. Age groups were 20–40 years with a mean age of  $26.74 \pm 3.8$ . The mean height was  $157 \pm 4.7$  cm. The mean weight was  $59.30 \pm 4.50$  kg. The mean BMI was  $22.1 \pm 1.40$ . Pap-HPV test was normal in 99/104 (95.19%) of the women. The mean FBS was  $84.60 \pm 4.60$ . The mean glycated Hb1Ac value was  $04.32 \pm 0.46$ . TSH values were in the range of 0.56–4.9.

**Discussion:** women in first trimester pregnancy undergo a battery of biochemical tests, serological tests which are directed to diagnose certain chromosomal disorders, abnormalities in the fetus, placenta, and maternal diseases. In the present study, BMI was high  $>25$  kg/m<sup>2</sup> in 52 patients (13.4%) and one of the patients developed complications during pregnancy. The Institute of Medicine published recommended weight gains by pre-pregnancy BMI which have been the standard for subsequent research.<sup>[1]</sup> The recommendations are for BMI  $< 19.8$  kg/m<sup>2</sup> total weight gain between 12.5 and 18 kg; BMI =  $19.8$ – $26.0$  kg/m<sup>2</sup> total weight gain between 11.5 and 16 kg; BMI  $> 26.0$ – $29.0$  kg/m<sup>2</sup> total weight gain between 7.0 and 11.5 kg, and for BMI  $> 29.0$  kg/m<sup>2</sup>.

**Conclusions:** Screening antenatal women with biochemical tests during first-trimester combined with screening at 11 weeks of pregnancy is beneficial to the mother and the infant as both step wise sequential screening and fully integrated screening have high rates of detection of various endocrine, cardiovascular diseases and renal of the mother and and congenital diseases of the fetus. Even though there is always possibility of false positive test results it outweighs the benefit.

**Key words:** Fetal, Human chorionic gonadotropin, Maternal, Placenta, Pregnancy, Ultrasound

## INTRODUCTION

Serum biochemical markers are used to assess maternal, placental, and fetal health. They help to diagnose and monitor maternal conditions such as gestational diabetes

and pre-eclampsia, trophoblastic diseases, and fetal chromosomal abnormalities such as Down's syndrome. These biochemical and hormonal tests constitute only one aspect of obstetric care. They should be used together with clinical findings and imaging, particularly ultrasonography.<sup>[1]</sup> The most common problems of pregnancy that should be excluded at this gestational age is gestational diabetes and pre-eclampsia.<sup>[2]</sup> The prevalence of gestational diabetes mellitus ranges from 1 to 14% depending on the populations studied.<sup>[1]</sup> Regular screening for gestational diabetes mellitus during first trimester enables early intervention which results in significant improvements in both fetal and maternal outcomes.<sup>[3]</sup> Pre-eclampsia occurs typically in the third

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trimester and affects 4–8% of pregnancies.<sup>[4]</sup> Placental health could be assessed by ultrasound examination, serum human chorionic gonadotropin (HCG) levels, beta-HCG ( $\beta$ -HCG) levels, and urinary HCG levels.<sup>[5]</sup> In assessing the fetal health during pregnancy, especially in the first and second trimesters to identify neural tube defects ultrasound examination is useful. In addition, estimation of  $\beta$ -HCG, alpha-fetoprotein (AFP), pregnancy-associated plasma protein-A (PAPP-A), and assessment of nuchal thickness of the fetus helps in the diagnosis of Down's syndrome.<sup>[6]</sup> The nuchal thickness is increased in Down's syndrome which can be detected in approximately 70% of cases by ultrasound in experienced centers.<sup>[7]</sup> In combination with biochemical markers, the detection rate increases to 85–90%.<sup>[8]</sup> Abnormal results can be followed up with direct karyotyping using chorionic villus sampling, but this carries a 0.5–1.0% risk of pregnancy loss in the first trimester. Recent advances show that using maternal growth hormone and insulin-like growth factor levels during the first and second trimester of pregnancy as predictors of fetal outcome is possible, but these are yet to be of routine clinical use.<sup>[9]</sup> With this background, the present study was conducted in a tertiary teaching hospital to identify the prevalence of abnormalities of placenta, fetus, and maternal diseases.

### Aim of the Study

This study aims to analyze the results of routine serum biochemical tests and ultrasound examination during the first trimester, in the diagnosis of paternal, placental, and fetal abnormalities.

### Institute of Study

The study was conducted at Kannur Medical College, Anjarakandy, Kannur, Kerala.

### Period of Study

The period of study was from May 2014 to April 2016.

## MATERIALS AND METHODS

A total of 384 women who were attending for antenatal checkups with the gestational age range of 11–14 weeks were included in the study. An Ethical Committee clearance was obtained from the Institutional Ethical Committee and standard pro forma approved by the ethical committee was used in the study. All the women were elicited about their clinical history followed by clinical examination. The presence of maternal or fetal abnormalities was noted. The following maternal serum biochemical tests were done: Pregnancy test (HCG), blood typing and red blood cells antibody screen, Pap test and human papillomavirus (HPV) testing, urine screen for glucose and/or protein, blood glucose, and hemoglobin A1c (HbA1c) test - for women at risk of Type 2 diabetes, thyroid-stimulating hormone (TSH) - for women with a

history of thyroid disease, human immunodeficiency virus screening, gonorrhea, chlamydia, and syphilis tests, hepatitis b and hepatitis c screening, and varicella zoster virus testing - to check for immunity to chickenpox; less routine, maternal serum free  $\beta$ -HCG, and PAPP-A. AFP is done women who have previous stillbirths. Demographic data were collected. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

A total of 384 women attending the Department of Obstetrics and Gynecology of a tertiary teaching hospital were included in the study. The women belonged to the age groups of 20–40 years with a mean age of  $26.74 \pm 3.8$ . The mean height was  $157 \pm 4.7$  cm. The mean weight was  $59.30 \pm 4.50$  kg. 87/384 (22.65%) belonged to high-income group, 178 (46.35%) belonged to middle-income group, and 119/384 (30.98%) belonged to low-income group. 344/384 (89.58%) were educated above 12<sup>th</sup> standard and the remaining 40 were (11.42%) below 12<sup>th</sup> standard [Table 1].

The laboratory data and ultrasound findings are tabulated in Table 2. The mean body mass index (BMI) value was  $22.1 \pm 1.40$  with a range of 20.2–46.2 kg/m<sup>2</sup>. All the patients in this study had a positive pregnancy test [Table 2]. The distribution of blood groups and Rh typing is tabulated in Table 2. The Pap-HPV test was done in 104 patients and showed normal in 99/104 (95.19%) of the women. Urine for sugar and proteins was abnormal in 43/384 (11.19%) and 68/384 (17.70%) patients. The mean fasting blood sugar (FBS) value was  $84.60 \pm 4.60$  with a range of 72–110. Among the women who showed abnormal FBS levels, 52/384 (13.54%) further tests were done to exclude Type 2 diabetes mellitus and none of them had diabetes. The mean glycated Hb1Ac value in this study was  $04.32 \pm 0.46$  with a range of 4.9–5.9. As the incidence of gestational diabetes, during pregnancy period is less likely if the Hb1Ac value is <5.3 in this study, it was taken as a cut off value.<sup>[10]</sup> The TSH values were in the range of 0.56–4.9, with a mean value of  $2.65 \pm 1.10$ .

**Table 1: The demographic data in the study (n=384)**

Observation	Mean values	Percentage
Age (years)	26.74±3.8	100
Below 35	25.10±1.30	75.26
Above 35	33.50±2.60	24.73
Height (cm)	157±4.7	-
Weight (kg)	59.30±4.50	-
Low income	87	22.65
Middle income	178	46.35
High income	119	30.98
Above 12 <sup>th</sup> Std.	344	89.58
Below 12 <sup>th</sup> Std.	40	11.42



**Table 2: The ultrasound and biochemical test values (n=384)**

Serum biochemical tests number performed	Range mean±SD	Number of normal tests (%)	Number of abnormal tests (%)
BMI- kg.m <sup>2</sup>	20.2–46.2 kg/m <sup>2</sup> , 22.1±1.40	332–86.45	52–13.54
Pregnancy test-HCG	--	positive in 100	-
Blood group Rh type-384 (%)			
A	186–48.43		
B	121–31.51		
AB	21–05.46	--	--
O	56–14.58		
Rh+ve	96.87		
Rh- ve	03.21		
Pap-HPV test-104	--	99–95.19	05–04.8
Urine- sugar- 384	--	341–88.80	43–11.19
Urine- proteins- 384	--	316–82.29	68–17.70
Fasting blood glucose-384	72–110, 84.60±4.60	332–86.45	52–13.54
HbA1c-255	4.9–5.9, 04.32±0.46		
<5.3	5.3–9, 5.5±0.42	238–93.33	17–6.66
>5.3	5.3–6.10, 5.8±0.48		
TSH-384	0.56–4.9, 2.65±1.10		
<5.3	1.2–3.6, 2.45±0.06	361–94.01	23–5.98
more than 5.3	5.3–6.9, 5.7±0.1.10		
CBC-384	--	294–76.56	90–23.43
HIV-384	--	379–98.69	05–1.3
Hepatitis B- 316	--	306–96.83	10–3.16
Hepatitis C	--	382–99.47	02–0.52
VDRL-384	--	379–98.60	05–1.30
Gonorrhea-192	--	187–97.39	05–2.60
Rubella-124	--	118–95.16	06–04.8
CMV-96	--	92–95.83	04.16
β-HCG-265			
0.05–2.0 MOM-254	0.05–2.0, 0.16±0.07	95.84	04.15
>2.0 MOM-11	2.0–7.18, 2.92±0.75		
PAPP-A-172			
<0.05 MOM- 12	0.042–0.05, 0.43±0.03	160–93.02	12–06.97
≥0.05 MOM- 160	0.05–0.062, 0.55±0.04		
AFP-183			
0.05–2.0 MOM-176	0.05–0.20, 0.14±0.50	176–96.17	07–3.82
>2.0 MOM-07	2.0–4.8, 2.70±1.10		

TSH: Thyroid-stimulating hormone, HIV: Human Immunodeficiency Virus, CMV: Cytomegalovirus, CRL: Crown-rump length, PAPP-A: Pregnancy-associated plasma protein-A, HbA1c: Hemoglobin A1c, HPV: Human papillomavirus, SD: Standard deviation, AFP: Alpha-fetoprotein, β-HCG: Beta-human chorionic gonadotropin, VDRL: Veneriological diseases research Laboratory

## DISCUSSION

Women in first trimester pregnancy undergo a battery of biochemical tests, serological tests which are directed to diagnose certain chromosomal disorders, abnormalities in the fetus, placenta, and maternal diseases. In the present study, BMI was high >25 kg/m<sup>2</sup> in 52 patients (13.4%) and one of the patients developed complications during pregnancy. The Institute of Medicine published recommended weight gains by pre-pregnancy BMI which have been the standard for subsequent research.<sup>[11]</sup> The recommendations are for BMI < 19.8 kg/m<sup>2</sup> total weight gain between 12.5 and 18 kg; BMI = 19.8–26.0 kg/m<sup>2</sup> total weight gain between 11.5 and 16 kg; BMI > 26.0–29.0 kg/m<sup>2</sup> total weight gain between 7.0 and 11.5 kg, and for BMI > 29.0 kg/m<sup>2</sup> total weight gain of 7.0 kg. In the present study, BMI was >26.0–29.0 kg/m<sup>2</sup> total weight gain between 7.0 and 11.5 kg. Pregnancy tests were positive in all the women. Pap test was positive in 5/384 (04.8%) and the tests were a false negative test as the

Pap tests were negative after delivery. The mean FBS value in this study was 84.60 ± 0.46 with a range of 71–110 mg%. Abnormal FBS levels of more than 110 mg% were noted in 53/384 (13.54%) patients and their corresponding Hb1Ac levels were normal in 34/52 (65.38%) of the women of <5.3. The remaining 19 women had normal delivery and no fetal abnormalities in the study. The mean Hb1Ac value was 04.32 ± 0.46 with a range of 4.9–5.9 in this study. Review of literature shows that glucose variability, characterized by extreme glucose excursions, may overlap with HbA1c levels giving rise to a risk of diabetes-related complications.<sup>[12,13]</sup> Patil *et al.* postulated an association between maternal hyperglycemia-induced oxygen free radical overproduction and fetal abnormalities, with the onset of diabetes-related embryopathy.<sup>[14]</sup> In addition to FBS, HbA1c is a useful parameter in assessing the metabolic regulation in pregnant women.<sup>[15]</sup> Thus, supplementation with HbA1c, as is common outside pregnancy, seems appropriate. The TSH values were in the range of 0.56–4.9, with a mean value of

2.65 ± 1.10. <3.5 mIU/L was seen 94.01% of the women and >3.5 mIU/L was observed in 23/384 (05.98%) women. The median levels of TSH during gestational weeks of 7–12 mean (1.47 mIU/L) were significantly than that of gestational weeks 4–6 values; (2.15 mIU/L).<sup>[16]</sup> The values of PAPP-A more than or equal to 0.5 MOM is considered normal, while levels <0.5 MOM are marked as low. In this study, the PAPP-A levels are ≥0.05 MOM - 160 in 160/172 women. There were 12/172 women who had undergone PAPP-A showing <0.05 MOM. Low maternal serum PAPP-A, at 11–13 weeks of gestation, is associated with stillbirth, infant death, intrauterine growth restriction, preterm birth, and pre-eclampsia in chromosomally normal fetuses, while a raised nuchal translucency is associated with specific structural abnormalities and genetic syndromes.<sup>[17]</sup> There are possibilities of these tests being false positive but the prevalence of false positive nature falls with the increasing maternal age.<sup>[18]</sup> Basically, PAPP-A is a large glycoprotein produced by the placenta and decidua having many functions including prevention of recognition of the fetus by the maternal immune system, matrix mineralization, and angiogenesis. Hence, a low PAPP-A is may lead to poor early placentation resulting in complications such as fetal growth restriction, fetal demise, preterm birth, and pre-eclampsia in the third trimester.<sup>[19]</sup> In a study b Morssink *et al.*,<sup>[20]</sup> 35% of the pregnant women with unexplained increased AFP level had at least one adverse perinatal outcome.<sup>[21]</sup> In the present study, there were seven abnormal test results in AFP values with mean value of 2.70 ± 1.10 and among them two patients had stillbirths [Table 2]. The adverse perinatal outcomes may be due to placental function disorders in patients with unexplained increase of maternal serum markers. Elevation of AFP was related to increased transition from fetomaternal circulation due to the placental fetomaternal surface damage.<sup>[22]</sup> Abnormal increased HCG levels were observed in 11 patients in this study with a mean value of 2.92 ± 0.75 [Table 2] which are thought to be due to decreased placental perfusion related to low oxidation stemming, cytotrophoblasts abnormal placentation induced by hypoxia were shown in the histological studies conducted by Liu *et al.*,<sup>[23]</sup> Studies also show low birth weight in infants born to mothers with high level of AFP.<sup>[23]</sup>

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# A Hospital-based Clinical Study on Risk Factors of Pterygium

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## Abstract

**Background:** Pterygium is a common ophthalmological disease seen in day-to-day practice. Many factors play their role individually and collectively in causing pterygium. The present study analyses the different risk factors in patients attending a tertiary teaching hospital.

**Aim of the Study:** This study aims to determine the risk factors associated with pterygium through history taking and examination findings.

**Materials and Methods:** A total of 46 patients with pterygium were included in the study excluding other systemic and local diseases producing dry eye. Thorough clinical and ophthalmology examination was done to know the risk factors contributing to pterygium. The breadth and pterygium on long axis was measured.

**Observation and Results:** Among the 46 patients, there were 35 (76.08%) males and 11 (23.91%) females with a male-to-female ratio of 3.18:1. The age of the patients was from 23 to 67 years with a mean age of  $49.63 \pm 3.72$ . Exposure to dust, hot, and dry atmosphere was in 34 (73.91%) patients. Exposure to toxic fumes and other irritating substances was observed in 29 (63.04%). 30 (65.21%) patients were working in outdoors when compared to 16 (34.78%) patients in indoors in this study. Xerophthalmia was reported by 22 (47.82%) of the patients in this study.

**Conclusions:** Even though the risk factors of pterygium identified in the study are outdoor exposure to ultraviolet light, toxic fumes, dust, and dry hot weather conditions. The examination findings point toward the presence of multiple associations simultaneously in most of the patients, and this overlap of associations indicates several factors operating together to cause pterygium and not a single factor.

**Key words:** Conjunctiva, Cornea, Exposure, Pterygium

## INTRODUCTION

Pterygium is a slow-growing proliferation of wing-shaped fibrovascular tissue that encroaches on the cornea. It arises from the conjunctiva,<sup>[1]</sup> subconjunctival connective tissue,<sup>[2]</sup> or from the limbal epithelial basal cells.<sup>[3]</sup> The prevalence of pterygium ranges from 0.7% to 31% in various studies around the world.<sup>[4]</sup> Earlier it was thought to be simply a degenerative process arising from pinguecula.<sup>[5]</sup> However, recently, reports have proved that pterygium is an active,

invasive, and inflammatory process associated with cellular proliferation, connective tissue remodeling, and angiogenesis leading to fibrovascular proliferation.<sup>[6]</sup> It can harbor malignancies such as squamous cell carcinoma<sup>[7]</sup> or malignant melanoma<sup>[6]</sup> which may become threat to the life. The risk factors described in the literature are exposure to dry, dusty, sunny, arid, and humid atmosphere of tropic and sub-tropical atmosphere.<sup>[8]</sup> The main symptoms are discomfort and watering of the eyes. It may progress to involve the cornea resulting in blindness. Pterygium formation was linked to corneal and conjunctival microtrauma caused by exposure to sunlight and particulate matter such as dust particles. Several modalities of surgical treatment have been advocated, but the recurrence rate remains high.<sup>[9,10]</sup>

Although the anti-inflammatory drugs and lubricants minimize the patient's discomfort, it cannot cure it. Surgical

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removal is the treatment of choice.<sup>[11]</sup> Methods of pterygium excision by bare sclera technique or McReynolds operation were associated with high recurrence. Adjunct therapies such as  $\beta$ -radiation, thiotepea, 5-FU, and mitomycin C remain controversial.<sup>[12]</sup> Autologous conjunctival grafting is reported to be the best method, giving both low recurrence rate and few complications. The present study was conducted to determine the risk factors associated with pterygium.

### Study Period

The period of study was from March 2002 to February 2004 (2 years).

### Institution of Study

The study was conducted at GGH, Kurnool Medical College, Kurnool, Andhra Pradesh.

## MATERIALS AND METHODS

A total of 46 patients attending the Department of Ophthalmology of Tertiary Teaching Hospital were included in this study. The Institutional Ethical Committee clearance was obtained and informed consent approved by the committee was obtained from the patients. Inclusion criteria: (1) Patients with pterygium aged between 20 and 70 years are included and (2) Patients with complaints of dry eye and tearing of eye with pterygium were included. Exclusion criteria: (1) Patients aged below 20 years and above 70 years were excluded, (2) Patients with primary and secondary Sjogren's syndrome were excluded, (3) Patients with other diseases causing dry eye were excluded, (4) Patients with inclusion cysts in pterygium were excluded, and (5) Patients with recurrence pterygium following surgery were excluded. A thorough clinical history taking was done. Patients were subjected to thorough ophthalmological examination to exclude other diseases of the eye affecting the tear film formation and function such as local ocular allergy, systemic allergy, endocrinal disorders, blepharitis, lacrimal apparatus blocks, drugs used locally for other diseases, and systemic collagen disorders. Demographic details of the subjects were collected. Risk factors of pterygium such as history of exposure to sunlight, duration of work in the outfields, exposure to toxic fumes, and working in cotton industry were observed. Slit lamp examination, visual acuity tests funduscopy were undertaken in all the patients. In relation to the actual pterygium; the side of involvement, size, nasal, or temporal disposition of the pterygium were noted. The extent of pterygium onto the cornea and breadth of it surrounding the cornea was recorded in millimeters. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 46 patients, there were 35 (76.08%) males and 11 (23.91%) females with a male-to-female ratio of 3.18:1. The age of the patients was from 23 to 67 years with a mean age of  $49.63 \pm 3.72$ . The incidence of pterygium was found in 22 (47.82%) patients and they belonged to the age group of 40–60 years [Table 1].

Among the 46 patients, exposure to dust, hot, and dry atmosphere was found in 34 (73.91%) patients. History of family members with pterygium was observed in 05 (10.86%) of the patients. A patient with a history of exposure to toxic fumes and other irritating substances was observed in 29 (63.04%) of the patients. 30 (65.21%) patients were working in outdoors when compared to 16 (34.78%) patients in this study. Xerophthalmia was reported by 22 (47.82%) of the patients in this study. In the present study, the risk factors identified were hot and dry weather conditions, exposure to chemical fumes, dust, and cotton fibers. The other factor was dry eye. 30 (65.21%) patients were working in outdoors when compared to 16 (34.78%) patients with a ratio of 1.8:1 in this study [Table 2].

Among the 46 patients, 21 (45.65%) patients had pterygium in the right eye, 19 (41.30%) in the left eye, and 06 (13.04%) had in both eyes. Patients with nasal side involvement

**Table 1: Showing the age and gender incidence of the study group (n=46)**

Age groups (years)	Male-35	Female-11	Percentage
20–30	06	03	19.56
30–40	08	02	21.73
40–50	09	06	32.60
50–60	07	00	15.21
60–70	05	00	10.86

**Table 2: The risk factors elicited on history (n=46)**

Observations	n (%)
Atmospheric conditions	
Hot and dry	34 (73.91)
Cold and humid	12 (26.08)
Exposure to toxic fumes-29	
Chemicals	12 (26.08)
Cotton fibers	14 (30.43)
Asbestos dust	03 (06.52)
Family history	
Yes	05 (10.86)
No	41 (89.13)
Dry eye	22 (47.82)
Type of work	
Outdoor	30 (65.21)
Indoor	16 (34.78)



were 33 (71.73%) and temporal side 13 (28.26%). Among 46 patients, 16 (38.78%) had Grade 1, 21 (45.65%) had Grade 2, and 09 (19.56%) had Grade 3 pterygium. The mean breadth of the pterygium at corneal limbus was  $57 \pm 0.72$  mm. The encroachment of pterygium onto the cornea was measured from limbus to apex of pterygium on a horizontal axis. The mean horizontal (encroachment) size of pterygium was  $2.2 \pm 0.24$  [Table 3].

## DISCUSSION

A total of 46 patients were included in the present study. Males were 35 (76.08%) and females were 11 (23.91%). The age of the patients was from 23 to 67 years with a mean age of  $49.63 \pm 3.72$ . In a similar study by Antony *et al.*,<sup>[13]</sup> the age range was 22–77 years with a mean age of 51.5 years; 59 men and 41 women. In another study by Kumar *et al.*,<sup>[14]</sup> the mean age was  $51.74 \pm 13.65$  and both sexes were equally involved. In this study, the incidence of pterygium was found in 31 (67.39%) patients and they belonged to the age group of 40–60 years. However, Rajiv *et al.*<sup>[15]</sup> reported higher incidence in the age group of 30–40. Exposure to dust, hot, and dry atmosphere was found in 34 (73.91%) patients unlike in the study by Mackenzie *et al.*<sup>[16]</sup> who reported an incidence of 86.63%. History of family members with pterygium was observed in 05 (10.86%) of the patients. In a similar study by Islam and Wagoner<sup>[17]</sup> who reported an incidence of family history in 10 (34.31%) patients. Patients with a history of exposure to toxic fumes and other irritating substances were observed in 29 (63.04%) of the patients similar to the study by Kwon JS *et al.*<sup>[16]</sup> reporting incidence in 63.25%. 30 (65.21%) patients were working in outdoors when compared to 16 (34.78%) patients in this study. Xerophthalmia was reported by 22 (47.82%) of the patients in this study. However, in a study by Rajiv *et al.*<sup>[18]</sup> it was 29.67%. There are multiple factors collectively playing their role in the causation of pterygium such as inflammation,<sup>[16]</sup> degenerative changes,<sup>[19]</sup> neoplastic,<sup>[20]</sup> and genetic<sup>[16]</sup> factors.

Recent studies have shown that exposure to ultraviolet (UV) rays was the cause of pterygium.<sup>[21,22]</sup> In the present study, the risk factors identified were hot and dry weather conditions, exposure to chemical fumes, dust, and cotton fibers. The other factor was dry eye. The present study has few limitations and does not confirm any association with other studies. It may be due to a comparatively clear weather conditions and with less dust pollution in Kerala. 30 (65.21%) patients were working in outdoors when compared to 16 (34.78%) patients with a ratio of 1.8:1 in this study. This finding is comparable to that of similar studies evaluating the relationship between outdoor work and pterygium conducted in different parts of the world.<sup>[16]</sup> Among the 46 patients, 21 (45.65%) patients had pterygium in the right eye, 19 (41.30%) in the left eye, and 06 (13.04%) had in both eyes. Patients with nasal side involvement were 33 (71.73%) and temporal side 13 (28.26%). Previous studies have shown that pterygium occur predominantly at the nasal limbus, while temporal pterygium is less common and rarely found in isolation.<sup>[23]</sup> Predilection for the medial limbus is explained by chronic focal UV damage to this region which activates limbal stem cells, leading to formation of a pterygium. Among 46 patients, 16 had Grade 1, (28.26%), 21 (45.65%) patients had Grade 2, and 09 patients (19.56%) had Grade 3 pterygium. The mean breadth of the pterygium at corneal limbus was  $57 \pm 0.72$  mm. The encroachment of pterygium onto the cornea was measured from limbus to apex of pterygium on a horizontal axis. The mean horizontal (encroachment) size of pterygium was  $2.2 \pm 0.24$  [Table 3].

## CONCLUSIONS

Even though the risk factors of pterygium identified in the study are outdoor exposure to UV light, toxic fumes, dust, and dry hot weather conditions. The examination findings point toward the presence of multiple associations simultaneously in most of the patients, and this overlap of associations indicates several factors operating together to cause pterygium, not a single factor.

**Table 3: Showing the examination findings of pterygium in the study subjects (n=46)**

Examination findings	n (%)
Right eye	21 (45.65)
Left eye	19 (41.30)
Both eyes	06 (13.04)
Nasal	33 (71.73)
Temporal	13 (28.26)
Grade 1	16 (38.78)
Grade 2	21 (45.65)
Grade 3	09 (19.56)
Mean breadth of pterygium	$5.7 \pm 0.72$
Mean horizontal encroachment	$2.2 \pm 0.24$

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# Prevalence of Cutaneous Manifestations in Patients with Diabetes Mellitus of North Kerala

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## Abstract

**Background:** Diabetes mellitus (DM) is the most common endocrinal disease which frequently has skin manifestations. The binding of a glucose molecule to the tissue protein results in an effect on structure and function of that protein and results in clinical manifestations of the disease. It is also suggested that increased cross-linkage of collagen of diabetic patients is responsible for their skin being generally thicker than that of non-diabetics. Advanced glycosylation end products are probably responsible for yellowing of skin and nails. Increased viscosity of blood due to stiff red blood cell membranes results in engorgement of the post-capillary venules in the papillary dermis, detected as erythema of the face, or periungual erythema. It is suggested that these skin changes may eventually be used as a reflection of the patient's current as well as past metabolic status.

**Aim of the Study:** The aim is to study the prevalence and pattern of cutaneous manifestations in patients with long-standing DM and their association with glycemic control, in this part of Kerala.

**Materials and Methods:** A prospective, descriptive, cross-sectional study was conducted on adult patients with long-standing DM attending the Department of Dermatology. The demographic data, duration of DM, treatment adopted, skin lesions, foot care, and glycemic details were recorded in a standard pro forma.

**Observations and Results:** Among 286 patients, 172 (60.13%) were males and 114 (39.86%) females. The male-to-female ratio of the present study was 1.5:1. The mean age was  $55.35 \pm 4.15$  years. Type I DM was observed in 78 (27.27%) and Type II DM in 208 (72.72%). Among the 286 patients included in this study, bacterial infections were observed in 117 (40.09%) patients, fungal infections in 98 (34.26%), pruritus in 103 (36.01%), acanthosis nigricans in 66 (23.07%), nail lesions in 52 (18.18%), diabetic foot 47 (16.43%), viral infections in 42 (14.68%), and acrochordons in 29 (10.13%) patients. The cutaneous lesions were more common in patients with unsatisfactory glycemic control.

**Conclusions:** Cutaneous lesions are common in DM, especially with unsatisfactory glycemic control. Bacterial, fungal, and viral infections are more common than other lesions. Type II DM has a higher frequency of infections and other lesions than Type I. Acanthosis nigricans has a gender predilection to females. Acanthosis nigricans is the next common skin lesions in DM after infections.

**Key words:** Cutaneous manifestations, Diabetes mellitus, Diabetic foot, Glycemic control, Nail diseases, Pruritus

## INTRODUCTION

Skin manifestations in long-standing diabetes mellitus (DM) are common and present clinically in various forms. If metabolic effects of endocrinal disturbance of glucose levels are considered as the cause for its effect on microcirculation

and skin collagen, the prevalence of skin manifestations may reach 100%. However, in certain skin manifestations, the pathophysiology is still uncertain. Rahbar<sup>[1]</sup> in 1968 showed that patients with DM have abnormal hemoglobin (Hb). This was later proven to be due to non-enzymatic condensation of glucose with Hb to form stable covalent adducts. Similar non-enzymatic glycosylation occurs with many tissue proteins including collagen; when the collagen protein is affected it results in skin color change which has been demonstrated by spectrophotometric measurement to correlate with diabetic complications.<sup>[2]</sup> The amino acid pentosidine and a yellow compound, 2-(2-furoyl)-4(5)-(2-furanyl)-1H-imidazole, have been identified in the skin of DM patients are advanced glycosylation end products which

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correlate with a cumulative score of diabetic complications.<sup>[3]</sup> The process of non-enzymatic glycosylation occurs in a minor extent at normal blood sugar concentrations but at an accelerated rate in persons with elevated blood sugars; glycosylation of the red cell membrane is apparently responsible for the stiffness of diabetic erythrocytes.<sup>[4]</sup> DM is classified into two types, DM Type I insulin-dependent diabetes (IDDM) and DM Type II non-IDDM- (NIDDM). In the year 2000, the global incidence of DM Type II was 171 million and is likely to be 366 million in the year 2030.<sup>[5]</sup> Long-standing DM can lead to irreversible functional changes in the body which results in various complications. Disturbed metabolism of glucose, amino acids, and lipids lead directly to physical signs in patients with DM. Approximately 30% of patients with DM have skin lesions. The uncommon lesions are diabetic dermopathy, necrobiosis lipoidica, diabetic bullae, diabetic thick skin, yellow skin, acanthosis nigricans, eruptive xanthomas, disseminated granuloma annulare, scleroderma, yellow nails, skin tags, diabetic rubeosis, and vitiligo and lichen planus. Commonly seen cutaneous bacterial infections in DM are folliculitis, furunculosis, carbuncle, ecthyma, cellulitis, and erysipelas. Cutaneous fungal infections encountered are pityriasis versicolor, oral, as well as, vulvovaginal candidiasis, and dermatophytosis. Other associated disorders are calciphylaxis, xerosis, xanthelasma, lipodystrophy, macular amyloidosis, and alopecia.<sup>[6]</sup> The commonly seen viral infections include herpes zoster and viral warts.<sup>[7]</sup> A large number of other cutaneous disorders may also be seen in diabetic patients, e.g., foot gangrene, pruritus, pallor and cold clammy skin of lower limbs, waxy skin, hemochromatosis, and finger pebbles.<sup>[6,7]</sup> The present study was conducted to study the prevalence and pattern of cutaneous manifestations in patients with long-standing DM and their association with glycemic control, in this part of Kerala.

### Type of Study

This was a prospective, descriptive, cross-sectional study.

### Period of Study

The study period was from May 2016 to October 2017.

### Institute of Study

The study was conducted at Kannur Medical College Hospital, Anjarakandy, Kannur.

## MATERIALS AND METHODS

A prospective, descriptive, cross-sectional study was conducted on adult patients with long-standing DM attending the Department of Dermatology, Kannur Medical College, Anjarakandy, Kannur, Kerala. A total of 286 patients from among the DM patients attending outpatient departments of both the Department of Medicine and Dermatology

presenting with skin lesions and complaints were included in the study. The demographic data, duration of DM, treatment adopted, skin lesions, foot care, and glycemic details were recorded in a standard pro forma. An Institutional Ethical Clearance was obtained, and a standard pro forma approved by the Ethical Committee was used in this study.

### Inclusion Criteria

The following criteria were included in the study:

1. Patients aged 20 years and above with DM.
2. Patients with DM for more than 5 years duration.
3. Patients with skin lesions or complaints related to the skin.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Patients who are pregnant.
2. Patients with critical systemic illnesses.
3. Patients with iatrogenic diseases with skin lesions.

A detailed history was obtained from the enrolled patients including duration of diabetes and mode of treatment for diabetes (i.e., diet only, oral hypoglycemic, insulin therapy, or combination therapy). After a detailed general, systemic, and cutaneous examination, the clinical diagnosis of dermatological findings was established. Laboratory investigations such as fasting blood sugar (FBS), random blood sugar, and HbA1c were advised to assess the glycemic control. Unsatisfactory glycemic control defined was HbA1c >7 as per the American Diabetic Association criteria. Other relevant laboratory investigations were advised where required including blood complete picture, renal profile, liver function tests, lipid profile, urine examination, and pus for culture and sensitivity. Any special tests such as Wood's lamp examination, fungal scrapings, skin biopsy, Tzanck smear, nail biopsy, and nail clippings were performed in doubtful cases. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 286 patients included in the study, there were 172 (60.13%) males and 114 (39.86%) females. The male-to-female ratio of the present study was 1.5:1. Patients belonging to the age group of 20–30 were 24 (8.39%), age group of 30–40 were 62 (21.67%), age group of 40–50 were 81 (28.32%), and 50–60 were 73 (25.52%). The mean age was  $55.35 \pm 4.15$  years. Type I DM was observed in 78 (27.27%) and Type II DM in 208 (72.72%). The other personal data are summarized in Table 1.

The mean duration of DM in males was  $9.42 \pm 1.50$  and in females was  $7.65 \pm 2.05$ . The glycemic profile showed mean FBS  $162 \pm 44.70$  g/dl (range = 89–260 g/dl) in



males and  $164 \pm 39.60$  g/dl (range 78–230 g/dl) in females. Mean HbA1c was  $8.62 \pm 1.07$  (range: 6–13%) in males and  $8.10 \pm 1.0$  (range: 8–12) in females [Table 2]. Based on this, the unsatisfactory glycemic control was present in 185 (64.68%) patients [Table 1].

Among the 286 patients included in this study, bacterial infections were observed in 117 (40.09%) patients, fungal

**Table 1: The demographic data and personal data of the study group (n=386)**

Observation	n (%)
Age in years	
20–30	024 (08.39)
30–40	062 (21.67)
40–50	081 (28.32)
50–60	073 (25.52)
60–70	046 (16.08)
Gender	
Male	172 (60.13)
Female	114 (39.86)
Type of DM	
Type I	078 (27.27)
Type II	208 (72.72)
Duration of DM in years	
5–8	085 (29.72)
9–11	139 (48.60)
>11	062 (21.67)
Treatment	
Diet <i>al. ne</i>	026 (9.09)
Oral hypoglycemic	095 (33.21)
Insulin	069 (24.12)
Combination	081 (28.32)
Other (Indian)	015 (05.24)
Glycemic control	
Satisfactory	101 (35.31)
Unsatisfactory	185 (64.68)
Personal hygiene bathing	
<5 times/week	021 (07.34)
>5 times/week	267 (93.3)
Pedicure	
Regular	066 (23.07)
Irregular	220 (76.92)
Wound care	
Prompt	242 (84.61)
Delayed	044 (15.38)
Type of footwear	
Open	199 (69.58)
Closed	087 (30.41)
Peripheral neuropathy	
Present	109 (38.11)
Absent	177 (61.88)

DM: Diabetes mellitus

**Table 2: The mean values of laboratory data (n - 286)**

Observation	Male	Female	P
Mean duration of DM in years	9.42±1.50	7.65±2.05	0.187
Mean FBS	162±44.70	164±39.60	0.341
Mean HbA1c	8.62±1.07	8.10±1.0	0.278

DM: Diabetes mellitus, FBS: Fasting blood sugar, HbA1c: HemoglobinA1c

infections in 98 (34.26%), pruritus in 103 (36.01%), acanthosis nigricans in 66 (23.07%), nail lesions in 52 (18.18%), diabetic foot 47 (16.43%), viral infections in 42 (14.68%), and acrochordons in 29 (9.13%) patients. The incidences of other lesions are tabulated in Table 3. The incidence of bacterial, fungal, and viral infections were correlated with the unsatisfactory glycemic profile of patients in the study and were found significant. These infections being more frequent in unsatisfactorily controlled DM. The data were statistically significant as the *P* value was below 0.05 (*P* value taken as significant at <0.05). The *P* value for bacterial infections was 0.038, fungal infections was 0.027, and viral infections was 0.041 [Table 3]. The gender preponderance in acanthosis nigricans was statistically significant as it was found more common in females. The *P* = 0.031 (*P* statistically significant at <0.05). The other values were not statistically significant as the *P* values were >0.05 [Table 3].

In this study, single skin lesion was observed in 178 (62.23%) patients, two lesions were observed in the same patient in 65 (22.72%) patients, three lesions were noted in 11 (03.84%), and four lesions in 06 (02.09%) patients [Table 4].

## DISCUSSION

Skin, being the largest organ of the body, is most likely to be affected by DM. The list of skin manifestations of DM is very big and different studies have reported a variable frequency ranging from 30 to 100%.<sup>[5,6]</sup> In few patients, the skin manifestation may be a presenting symptom or sign.<sup>[6]</sup> Therefore, skin changes may even be seen sometime before the development of diabetes. Patients with DM of longer duration have more severe skin pathologies.<sup>[8]</sup> Apart from the basic molecular level changes in the connective tissue of skin and endothelium of the venules and capillaries causing skin lesion in DM, the factors accounting for dermatologic complications are neuropathy, macro- or micro-angiopathy, immunosuppression, and dyslipidemia.<sup>[9]</sup> There is no difference in the prevalence of skin lesion according to the type of DM whether Type I or Type II. However, the infections are more common in Type II DM and immune-related dermatoses are more common with Type I DM.<sup>[10]</sup> The mean age of presentation in this study was  $55.35 \pm 4.15$  years. The study by Ahmed *et al.*<sup>[5]</sup> observed that the mean age was 54 years. Similarly, Basit *et al.*<sup>[11]</sup> also reported the mean age of 56.16 years. The male-to-female ratio of the present study was 1.5:1. The mean duration of DM in the present study was  $9.42 \pm 1.50$  in males and was  $7.65 \pm 2.05$  in females. The duration range was 5–13.45 years. The glycemic profile showed mean FBS  $162 \pm 44.70$  g/dl (range = 89–260 g/dl) in males and

**Table 3: Various skin diseases encountered in the study (n=286)**

Skin lesions	n (%)	Male - 172 (%)	Female - 114 (%)	P	Satisfactory glycemic control	Unsatisfactory glycemic control	P
Bacterial infections*	117 (40.90)	87 (50.58)	30 (26.31)	0.321	28	79	0.038
Fungal infections*	98 (34.26)	61 (35.46)	37 (32.45)	0.256	19	79	0.027
Viral infections*	42 (14.68)	30 (17.44)	12 (10.52)	0.411	12	30	0.041
Pruritus	103 (36.01)	56 (32.55)	47 (41.22)	0.125	42	61	0.210
Nail changes	52 (18.18)	28 (16.27)	24 (21.05)	0.401	22	30	0.311
Acanthosis nigricans*	66 (23.07)	17 (9.88)	49 (42.98)	0.021	19	47	0.031
Acrochordons	29 (10.13)	17 (9.88)	12 (10.52)	0.153	11	18	0.351
Diabetic thick skin	22 (7.69)	14 (8.13)	08 (7.01)	0.190	07	15	0.283
Necrobiosis lipoidica	21 (7.34)	16 (9.30)	15 (13.15)	0.311	08	13	0.311
Eruptive xanthomas	06 (2.09)	04 (2.32)	02 (01.75)	0.432	02	04	0.412
Diabetic foot	47 (16.43)	28 (16.27)	19 (16.66)	0.610	20	27	0.378
Granuloma annulare	05 (01.74)	03 (01.74)	02 (01.75)	0.311	01	04	0.291
Lichen planus	06 (02.09)	03 (01.74)	03 (02.63)	0.279	02	04	0.510
Perforating dermatosis	08 (02.79)	05 (02.90)	03 (02.63)	0.241	03	05	0.601
Diabetic bullae	07 (02.44)	04 (02.32)	03 (02.3)	0.186	02	05	0.438
Schamberg's dermatitis	05 (01.74)	03 (01.74)	02 (01.75)	0.153	0	04	0.361
Macular amyloidosis	07 (01.74)	04 (02.32)	03 (02.63)	0.205	03	04	0.251
Xanthelasma	30 (10.48)	18 (10.46)	12 (10.52)	0.561	12	18	0.214
Macular amyloidosis	09 (03.14)	05 (02.90)	04 (03.50)	0.701	03	06	0.184
Rubeosis	04 (01.39)	02 (01.16)	02 (01.75)	0.619	02	02	0.231

\*P value is significant at &lt;0.05

**Table 4: Number of patients showing more than one lesion (n=286)**

Skin Lesions (%)	Male- 172	Female- 114
1 lesion - 178 (62.23)	100	78
2 lesions - 065 (22.72)	42	23
3 lesions - 011 (03.84)	06	05
4 lesions - 006 (02.09)	04	02

164 ± 39.60 g/dl (range 78–230 g/dl) in females. Mean HbA1c was 8.62 ± 1.07 (range: 6–13%) in males and 8.10 ± 1.0 (range: 8–12) in females in this study. The study by Bhat *et al.*<sup>[12]</sup> has reported similar figures for uncontrolled diabetes and associated dermatological features. However, Ahmed *et al.*<sup>[5]</sup> reported a higher frequency in uncontrolled diabetes. The wide variation in reporting may be due to various factors such as study design and setting which in turn may be dependent on the availability of medical facilities, hygiene, literacy level, and lack of awareness about the disease.<sup>[3,4]</sup> In this study, bacterial infections were observed in 117 (40.09%) patients, fungal infections in 98 (34.26%), pruritus in 103 (36.01%), acanthosis nigricans in 66 (23.07%), nail lesions in 52 (18.18%), diabetic foot 47 (16.43%), viral infections in 42 (14.68%), and acrochordons in 29 (10.13%) patients. There was no relationship of skin infections with gender, but patients with poor glycemic control were found to be more prone to infections, especially bacterial. However, in the study by Basit *et al.*,<sup>[11]</sup> there was a preponderance of bacterial infections in males. The higher incidence of infections in this part of Kerala may be due to high humidity during rainy seasons and dry heat in summer.

Vahora *et al.*<sup>[10]</sup> reported a lesser frequency of bacterial infections in their patients. Naheed *et al.*<sup>[13]</sup> reported a higher frequency of bacterial infections in Type 2 DM. Bacterial infective lesions commonly seen in DM are impetigo, folliculitis, furunculosis, carbuncle, ecthyma, cellulitis, and erysipelas caused by *Staphylococcus aureus* and *Streptococcus pyogenes*. Candidiasis was the most common fungal infection in this study. This fungal infection may be taken as an indicator for undiagnosed DM. Tinea pedis was the most common dermatophytosis observed in this study. The second most common dermatosis was acanthosis nigricans, especially in DM Type II patients. This was less frequent than the infections in this study. Al-Mutairi<sup>[14]</sup> gave an explanation for this associated dermatological feature with lesser frequency due to the fact that it is not due to uncontrolled diabetes but due to insulin resistance; the high levels of insulin act on the insulin-like growth factor receptors and lead to the formation of the acrochordons and acanthosis nigricans. National and international studies have shown the association of acrochordons with Type II DM. In this study, the incidence was 10.13% similar to the study by Vahora *et al.*<sup>[10]</sup> The incidence of diabetic foot in this study was 16.43%. Diabetic foot is usually related to different mechanisms playing their role in its development and resistance for treatment in DM. They are usually related to different mechanisms such as impaired immunity, neuropathy, peripheral arterial disease, venous insufficiency, and lymphedema. Mansour and Imran<sup>[15]</sup> observed the diabetic foots being more common in males. Other studies have also confirmed the association.<sup>[16]</sup> Pruritus was the fourth common complaint with 36.01% of the patients presented in this study group. Al-Mutairi<sup>[14]</sup>

has reported the frequency in a study similar to this as 47%. This was much higher in frequency as compared to our study with 36.01% presenting with pruritus. In the present study, the frequency of necrobiosis lipoidica was 07.34%. The association between DM and this skin lesion was reported by many authors<sup>[17,18]</sup> of DM has been regularly reported in different studies. Diabetic thick skin was seen in 7.69% of the study group patients. This is caused by non-enzymatic glycosylation of collagen making it less soluble. As the duration of diabetes increases, it leads to progressive glycosylation of the subcutaneous components. Korkmaz *et al.*<sup>[19]</sup> reported a similar frequency of thick skin in their study. Other dermatological features having a frequency <5% were as follows: Spontaneous blisters, granuloma annulare, lichen planus, vitiligo, and eruptive xanthomas. Other workers have also reported a low frequency of these disorders in association with DM.<sup>[12,20]</sup> The present study showed that there is a definite association between unsatisfactory glycemic control and prevalence of dermatological diseases in patients with DM irrespective of their type. A good glycemic control reduces the incidence and severity of cutaneous disorders with or without known pathogenesis.<sup>[21,22]</sup> Longer the duration of DM in patients, long-term effects of DM on the microcirculation and dermal collagen eventually result in skin disorders in almost all diabetic patients. The role of a dermatologist is to identify the skin lesions and in undiagnosed DM patients to investigate for confirmation of the pre-existing disease. This would help in reducing the dermatological morbidity, improvement of the quality of life, and management strategy of diabetic patients.

## CONCLUSION

Cutaneous lesions are common in DM, especially with unsatisfactory glycemic control. Bacterial, fungal, and viral infections are more common than other lesions. Type II DM has a higher frequency of infections and other lesions than Type I. Acanthosis nigricans has a gender predilection to females. Acanthosis nigricans is the next common skin lesions in DM after infections. Other dermatological features having a frequency <5% were as follows: Spontaneous blisters, granuloma annulare, lichen planus, vitiligo, and eruptive xanthomas. Achieving good glycemic control can reduce bacterial and fungal infections.

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# Clinical Study on Risk Factors and Evaluation of Severity in Dry Eye

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## Abstract

**Background:** “Dry eye” (DE) or keratoconjunctivitis sicca is a benign condition of the eye characterized by dryness of the eyes, gritty, scratchy, and irritating feeling in the eyes. The causes can be ocular and non-ocular. A clinical study is conducted to analyze the risk factors causing it in a hospital-based study.

**Aim of the Study:** This study aims to study and analyze the risk factors causing DE in a tertiary teaching hospital.

**Materials and Methods:** A prospective, cross-sectional study was conducted, and 168 patients with symptoms of DE were included in the study. Demographic data were collected. Risk factors such as climate, working place, profession, contact lenses, menopause and use of decongestant, previous ocular surgery, estrogen therapy, and diabetes were elicited. Ophthalmological examination was done to evaluate vision and other pathological conditions. DE was confirmed by tear film breakup time (TBUT) and Schirmer I test.

**Observations and Results:** Schirmer and TBUT values were lower in elderly female patients, those working in hot and dry climate and dusty and fumes atmosphere. Farmers and hard laborers were more prone for DE. Diabetes Type II and post-operative Lasik surgery are common risk factors observed. There was statistical significance between severities of DE by Schirmer test and TBUT with diabetes mellitus (DM) Type II, Lasik surgery with  $P = 0.042$  and  $0.004$ , respectively.

**Conclusion:** The major risk factors of DE were hot and dry climate and dusty and fumes atmosphere, DM Type II, and Lasik surgery. If untreated, these may lead to severe complications.

**Key words:** Contact lens, Decongestants, Diabetes Type II, Dry eye, Estrogen, Hemoglobin 1A, Menopause

## INTRODUCTION

The dry eye (DE) was defined as “multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface” by the DE Workshop Committee.<sup>[1]</sup> It is also sometime accompanied by the increase osmolality of the tears and inflammation of the ocular surface.<sup>[2]</sup> The damage to the ocular surface may include corneal epithelial disruption resulting in visual disturbances.<sup>[3]</sup> The tear production may be decreased, evaporation of tears increased, and pathological changes

in the meibomian glands resulting in change in the composition of the tears.<sup>[4]</sup> Review of literature shows wide variation in the prevalence of symptoms (65–50%) and signs of DE (10–16%) in different countries including the USA, Australia, Taiwan, and China. It may be attributed to the different questionnaires used in these studies and different test parameters laid down to define and diagnose the DE.<sup>[5–8]</sup>

DE leads to reduction in quality of life when symptoms are unbearable. These symptoms range from mild transient irritation to persistent dryness, burning, itchiness, redness, pain, ocular fatigue, and visual disturbance.<sup>[9]</sup> Most studies of the studies on DE are conducted in developed countries and in elderly populations, hence, there is lack of ethnic diversity.<sup>[10,11]</sup> There are many non-ocular diseases which may also lead to DE like diabetes mellitus (DM), especially Type II. In these patients, ocular surface has reduced corneal sensitivity and by alteration in tear quantity and

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quality.<sup>[12]</sup> DM patients also might exhibit DE symptoms probably due to neuropathy, metabolic dysfunction, or abnormal lacrimal secretions.<sup>[13]</sup> Similarly, damage to the microvasculature of the lacrimal gland accompanied by autonomic neuropathy might impair lacrimation in persons who suffer from diabetes for a long time. Patients with diabetic retinopathy do not complain of symptoms of DE, but they have pathological and clinical signs of keratoconjunctivitis sicca.<sup>[14]</sup> In this context, the present study was conducted to study and analyze the risk factors causing DE in a tertiary teaching hospital.

## MATERIALS AND METHODS

A total of 178 patients of all age groups with symptoms of DE attending the Outpatient Department of Regional Eye Hospital, Kurnool, were included in the study. An Ethical Committee Clearance was obtained and a questionnaire approved by the Ethical Committee was used in the study.

### Inclusion Criteria

(1) Patients aged above 10 years were included in the study. (2) Patients with symptoms of DE such as dryness, irritation, foreign body sensation in the eyes, gritty feeling, difficulty to blink, and diminished vision were included. (3) Patients using medications such as antihistamines or antidepressants, oral contraceptives, and diuretics were included. (4) Patients who had undergone Lasik surgery were included. (5) Patients wearing contact lenses were included. (6) Patients having Sjogren's syndrome, rheumatoid arthritis, systemic lupus erythematosus, and Parkinson's disease were included. (7) Patients with smoking habit were included. (8) Patients with Vitamin A deficiency were included. (9) Pregnant women were included.

### Exclusion Criteria

(1) Patients ages below 10 years were excluded. (2) Patients with critical illnesses were excluded. (3) Patients with severe cardiac or renal disorders were excluded. A questionnaire approved by the Ethical Committee was used.<sup>[15,16]</sup> It contained questions: (1) Do your eyes ever feel dry? (2) Do you ever feel a gritty or sandy sensation in your eye?, (3) Do your eyes ever have a burning sensation? (4) Are your eyes ever red? (5) Do you notice much crusting on your lashes?, and (6) Do your eyes ever get stuck shut? Distribution of each DE symptom by frequency of response was also elicited as Grade 0: Never, Grade 1: Rarely, Grade 2: Sometimes, Grade 3: Often, and Grade 4: All the time. Demographic data were elicited like information about age, gender, current occupation, and current cigarette smoking status, and household fuel use was also collected. The profession of the patients was elicited like agricultural (fisherman, farmers, hard laborer,

office goers, housewives and students, factory workers, and shopkeepers). Primary fuel used for cooking was divided into gas/kerosene and charcoal/firewood categories. Ophthalmological examination included examination for pterygium and autorefractometry. DE was confirmed by tear film breakup time (TBUT) and Schirmer's I test. Diagnosis was established by positivity of one or both the tests (TBUT or Schirmer's test). Structures of the eye were assessed with slit lamp biomicroscopy examination. Retinal status was evaluated by indirect ophthalmoscopy after pupillary dilation. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 178 patients, there were 107 (60.11%) female patients and 71 (39.88%) male patients with male-to-female ratio of 1.5:1. The patients belonged to the age groups of 10–70 years with a mean age of  $45.30 \pm 5.70$ . Patients living in hot and dry climate were 86 (48.31%), in dusty and fumes were 62 (34.83%), and cold and wet climate were 30 (16.58%). There was a history of smoking in 51 (28.65%). The household fuel used was gas in 113 (63.48%), firewood in 21 (11.79%), and kerosene in 44 (24.71%). 48 were farmers (26.96%), 39 were hard laborers, office goers were 36 (20.22%), and housewives were 35 (19.66%). Workplace was air conditioned in 32 (17.97%), hot and humid in 41.57%, and dusty fumes and dry in 72 (40.44%) patients. Among the women, 86 (48.41%) had attained menopause. 38 patients were using contact lenses (21.34%). Patients who had undergone Lasik surgery were 15 (8.42%). 17 (9.55%) patients were using decongestants. 19 (23.03%) patients were using estrogen. 54 (30.33%) patients were having DM Type II; among them, 48 (26.96%) patients had  $>7.0\%$  of hemoglobin 1Ac (Hb1Ac) levels [Table 1].

Grading of the DE was done depending on the severity of the symptoms and Grade 3 was observed in 79 (44.38%) and Grade 4 was observed in 55 (30.89%) of the patients [Table 2].

Moderate grade TUBT test was observed in 89 (50.00%) and severe grade TUBT test was observed in 68 (38.20%) patients. Schirmer's test in moderate grade was found in 83 (46.62%) and severe grade in 54 (30.33%) patients [Table 3].

Among 54 of the 86 patients who were living in hot and dry climates were observed with moderate-to-severe grades of TUBT and Schirmer's test which was found to be statistically significant observation with  $P = 0.013$  ( $P$  significant at  $<0.05$ ). Patients who were farmers, hard laborers showed moderate-to-severe grade TUBT and

Schirmer' test results which were significant with  $P$  value at 0.024 and 0.031, respectively. However, office goers showed severe and moderate grade TUBT and Schirmer's test in 27.77% and not significant with  $P$  value at 0.160 [Table 4]. Similarly, work places with hot and humid atmosphere and dusty with fumes were significant with  $P$  values at 0.035 and 0.028, respectively. Patients with uncontrolled DM with  $>7.0$  Hb1Ac levels were significantly affected in the study with moderate-to-severe test results showing  $P = 0.042$ . Patients who had undergone Lasik surgery were affected in 80% of the patients with DE and significant statistically with  $P$  value at 0.004 [Table 4].

**Table 1: The various risk factors elicited in the study ( $n=178$ )**

Observation	Number (%)
Mean age	45.30 $\pm$ 5.70
Gender	
Male	071 (60.11)
Female	107 (39.88)
Climate	
Hot and dry	86 (48.31)
Dusty and fumes	62 (34.83)
Cold and wet	30 (16.58)
Smoking	
Yes	051 (28.65)
No	127 (71.34)
Household fuel	
Gas	113 (63.48)
Firewood	021 (11.79)
Kerosene	044 (24.71)
Profession	
Housewife	35 (19.66)
Student	19 (10.67)
Hard labor	39 (21.91)
Farmers	48 (26.96)
Office goers	36 (20.22)
Working place	
Air conditioned	32 (17.97)
Hot and humid	74 (41.57)
Dusty, fumes, and dry	72 (40.44)
Menopause	
Yes	86 (48.41)
No	21 (11.73)
Use of contact lenses	
Yes	038 (21.34)
No	120 (67.41)
Lasik surgery	
Yes	015 (08.42)
No	163 (91.57)
Use of decongestants	
Yes	017 (09.55)
No	161 (90.44)
Use of estrogen	
Yes	041 (23.03)
No	137 (76.96)
DM-62	
Type I	008 (04.49)
Type II	054 (30.33)
Hb1Ac $<7.0$	016 (08.98)
Hb1Ac $>7.0$	048 (26.96)

Hb1Ac: Hemoglobin 1Ac, DM: Diabetes mellitus

## DISCUSSION

The present study was a prospective study conducted in a tertiary teaching hospital which was also regional eye hospital to study and analyze the risk factors causing DE. Comparison between the studies of various countries is difficult because these population-based studies evaluating DE differ in the choice of DE questionnaire and objective

**Table 2: The grades of DE in the patients of the study ( $n=178$ )**

Grading of DE	Number (%)
Grade 1	09 (5.05)
Grade 2	35 (19.66)
Grade 3	79 (44.38)
Grade 4	55 (30.89)

DM: Diabetes mellitus

**Table 3: The TBUT and Schirmer's test results ( $n=178$ )**

Tests and results	Number (%)
TUBT test	
$>10$ s (normal)	02 (01.11)
8–10 s (mild)	19 (10.67)
5–7 s (moderate)	89 (50.00)
$<5$ s (severe)	68 (38.20)
Schirmer's test	
$>10$ mm (normal)	06 (03.37)
8–10 mm (mild)	25 (14.04)
5–7 mm (moderate)	83 (46.62)
$<5$ mm (severe)	54 (30.33)

TBUT: Tear film breakup time

**Table 4: The correlation between common risk factors, TBUT, Schirmer's test results, and grading of the DE in the study ( $n=178$ )**

Risk factors	Symptoms Grading 3 and 4 (%)	TUBT- and Schirmer's test results- moderate and severe (%)	$P$
Climate			
Hot and dry	62/86 (72.09)	54/86 (62.79)	0.013
Dusty and fumes	51/62 (82.25)	47/62 (75.80)	0.021
Profession			
Hard labor	28/39 (71.79)	23/39 (58.97)	0.024
Farmers	39/48 (81.25)	30/48 (62.50)	0.031
Office goers	27/36 (75.00)	10/36 (27.77)	0.413
Working place			
Hot and humid	57/74 (77.02)	51/74 (68.91)	0.035
Dusty, fumes	53/72 (73.61)	45/72 (62.50)	0.028
DM			
Hb1Ac			
$>7.0$ –48	31/48 (64.58)	33/48 (68.75)	0.042
Lasik surgery			
Yes	14/15 (93.33)	12/15 (80.00)	0.004

Hb1Ac: Hemoglobin 1Ac, DM: Diabetes mellitus, TBUT: Tear film breakup time

tests, definitions of DE and the selection of the study population.<sup>[17]</sup> There was increased reporting of DE with increasing age earlier.<sup>[17,18]</sup> Schein *et al.*<sup>[19]</sup> found no age correlation to exist. In this study, an association with age was observed on Univariate analysis but was not significant after adjustment for all other variables. There were reports mentioning the prevalence of DE among the women in many studies.<sup>[20-22]</sup> In this study, such prevalence was not observed. Estrogen deficiency during menopause was thought to explain the DE in women.<sup>[22,23]</sup> In the present study, 41 (23.03%) of women were using estrogen, but only 10/41 showed moderate-to-severe grades of TUBT and Schirmer's test results so were not significant. Moss *et al.*<sup>[10]</sup> observed smoking as a risk factor, but in this study, smoking was not found as a risk factor because 51 patients (28.65%) were smokers and the TUBT and Schirmer's results were only mild grade hence not significant. Correlation between the moderate and severe grades of symptoms and the moderate and severe grades of TUBT and Schirmer's test results was statistically significant with  $P < 0.05$  in regard with the risk factors such as (1) Climate: Hot and dry and dust and fumes, (2) Professions such as farmers and hard laborers working under the sun, (3) Lasik surgery, and (4) DM Type II in the present study. Similar findings were observed in a study by Magdum *et al.*<sup>[24]</sup> It should be noted that symptoms reported can be due to other conditions (for example, blepharitis) and that DE disease can be symptomless.<sup>[25]</sup> While assessing the grading of the DE assessment of symptoms has been recommended besides tear stability/dynamic and ocular surface damage assessment.<sup>[26,27]</sup> Brennan and Efron<sup>[28]</sup> reported DE in 75% of the contact lens wearers. In the present study, only 38 (21.34%) were using contact lenses and the severity of DE was mild. It should also be noted that advances in contact lens technology between 1986 and 2005 may or may not be a factor in DE symptom prevalence. In this study, people who were diagnosed and have had previous treatment for DE were shown to be still having symptoms. Smoking was not associated with symptomatic DE disease in this study unlike the observations made by Tong *et al.*<sup>[29]</sup> Smoking as a risk factor is controversial; reported as a risk factor in one study<sup>[6]</sup> and not as a risk factor in another.<sup>[19,30]</sup> There are few shortcomings in this study such as the systemic diseases such as Sjogren's syndrome and other collagen tissue disorders, Vitamin A deficiency,<sup>[31]</sup> Hepatitis C infection,<sup>[32]</sup> androgen deficiency,<sup>[33]</sup> and radiotherapy are not evaluated as risk factors.

## CONCLUSION

The major risk factors of DE were hot and dry climate and dusty and fumes atmosphere, DM Type II, and Lasik surgery. If untreated, these may lead to severe complications.

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# A Clinical Study on Risk Factors Cataracts in Young Adults

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## Abstract

**Background:** Cataracts in general population accounts for more than 80% of the causes for impaired vision in India. Usually, cataract formation is a senile disorder due to aging process. However, they may also be formed in young adults. The present study reviews risk factors in younger age groups developing cataracts.

**Aim of the Study:** The aim is to study the risk factors of early cataract formation in young adults in a hospital setup.

**Materials and Methods:** In a hospital-based prospective, comparative, cross-sectional clinical study, 183 young patients with diminished vision and nuclear, cortical, posterior subcapsular (PSC), mixed, and posterior polar cataracts were included in the study. Risk factors such as sunlight exposure, atopy, diabetes, steroid intake, glaucoma, and uveitis were elicited.

**Observations and Results:** Among the 183 patients enrolled, 115 (62.84%) were males and 78 (42.62%) were females. The mean age was  $39.46 \pm 3.15$ . Family history was observed in 27.82% of the patients, atopy in 41.73%, trauma in 23.47%, exposure to ultraviolet light (UVL) in 32.17%, uveitis in 25.21%, diabetes mellitus in 26.95%, renal disorders in 10.34%, myxedema in 06.08%, dehydration in 08.69%, glaucoma in 14.78%, hypertension in 33.04%, and usage of steroids in 25.21%. No risk factor mentioned above was elicited in 26.08% of the patients and termed as idiopathic.

**Conclusion:** Atopy documented higher odds for nuclear cataract (35.41%) with  $P = 0.041$  ( $P$  significant at  $<0.05$ ), attaining statistical significance compared to other types. Steroids being the risk factor to cause cataracts was 25.21%, the  $P = 0.382$  which was significant. For diabetes-induced cataracts, it was not statistically significant with  $P = 0.610$ . Risk factors for cataracts in younger age groups were atopy, steroids, uveitis, and exposure to UVL. Idiopathic cataracts were the second most common type in the study.

**Key words:** Cataract, Diabetes mellitus, Diminished vision, Hypertension and immature cataract, Young age

## INTRODUCTION

Multiple etiological factors play their role in the development of cataract. They are genetic,<sup>[1]</sup> sociodemographic,<sup>[2]</sup> behavioral, and environmental factors<sup>[3,4]</sup> acting singly or in combination resulting in a cataract. However, age is the most important risk factor among all the other factors in cataracts. In India, the cataracts account for more than 80% of the patients with diminished vision.<sup>[5,6]</sup> Compared to industrialized western countries, cataracts have an earlier

age of onset in India.<sup>[7,8]</sup> In a comparative study conducted in Punjab comparing with the prevalence rates according to age with Framingham eye center in the United States of America, the age-specific prevalence of cataract in India was 3 to 6 times higher.<sup>[7]</sup> Such findings suggest that may be the Indian population is either genetically prone or widely exposed to environmental risk factors (ultraviolet light [UVL], nutritional deficiencies, and severe dehydration from diarrhea/heatstroke).<sup>[9-11]</sup> Other research workers have studied the role of demographic features such as age, gender, socioeconomic factors, smoking, exposure to UVL, drug usage, and childbearing; anthropometric factors such as higher body mass height and weight; and comorbid diseases such as diabetes, hypertension, myxedema, and renal disorders.<sup>[1-4,10-18]</sup> Studies on early age cataracts are limited on similar lines as mentioned above, but the available studies show that nearly 50% of the patients in such studies were exposed to trauma, intraocular

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inflammation, diabetes, and usage of steroids before developing cataracts.<sup>[19-21]</sup> Few studies in India have shown an association of early cataracts with dehydration crises and childbearing.<sup>[10-12,22]</sup> The present study is undertaken to find the various risk factors causing early cataracts in a Regional Eye Hospital based setup catering to the needs of population belonging to Rayalaseema of Andhra Pradesh.

### Type of Study

This was a retrospective, comparative, cross-sectional study.

### Period of Study

The study period was from May 2003 to October 2005.

### Institute of Study

The study was conducted at Regional Eye Hospital, Kurnool Medical College Kurnool, Andhra Pradesh.

## MATERIALS AND METHODS

A total of 183 patients visiting the Regional Eye Hospital, Kurnool, with complaints of diminished vision and diagnosed as cataracts were included in the present study. An ethical committee clearance was obtained before commencing the study.

### Inclusion Criteria

The following criteria were included in the study:

1. Patients aged above 30 years and below 45 years.
2. Patients with a history of diminished vision.
3. Patients with family history of early age cataracts. Patients with a history of trauma, exposure to UVL, and inflammations of the eyeball.
4. Patients with unilateral or bilateral diminished vision.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Patients aged below 30 and above 50 years.
2. Patients who were pregnant.
3. Patients who have undergone cataract surgery.

All the medical records of the patients who underwent cataract surgery were collected from medical records section of the hospital to collect the data. The demographic data were collected from the records. Slit-lamp examination was performed using standardized illumination and magnification, findings were collected. The type of cataract was determined using the direct observation and retro illumination method. The cataracts were classified as (1) nuclear, (2) cortical, (3) posterior subcapsular (PSC), (4) posterior polar (PP), and (5) mixed cataract. The axial length (AXL) was measured 10 times in each eye using an A scans and an average value obtained. Intraocular pressures were measured by applanation tonometry, and

all the participants underwent a dilated fundus examination using indirect ophthalmoscopy. An atopy questionnaire was used to elicit the history of allergic disorders such as bronchial asthma, atopy, and other skin and/or food allergies. Information regarding trauma, sunlight exposure, steroid intake, drugs used, diabetes, myopia, myxedema, renal disorders, and previous history of inflammations of the orbit or eye ball (uveitis) were collected. Those patients who gave positive history to allergic symptoms were further investigated by antigen-specific immunoglobulin E estimations to confirm atopy. Exposure to UVL was taken as positive where the patients have worked > 8 h/day and 6 days in a week for more than 10 years. Diabetes was confirmed by positive glucose tolerance test. Steroids usage was taken as risk factor if the patients had used oral, injectable, inhaled steroids, or in combination for more than 6-month duration. Participants were classified as high myopia if their AXL was more than 26 mm. All the patients who did not show any risk factor in their history or examination were classified as idiopathic cause. Patients with mixed and cortical cataract were combined into a single category representing "other" types. The nuclear cataract, PSC, and PP cataracts are considered as a single unit as well as reference category. The influences of risk factors on these two categories are compared with the later as a reference unit. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 183 patient's records included in the present study, there were 131 (71.58%) bilateral cataracts and 52 (28.41%) unilateral cataracts. Among 131 patients with bilateral cataracts, 16 (12.21%) had dissimilar cataracts in each eye and hence were excluded from the study. Finally, 115 eyes (patients) (87.78%) only of 131 were included in the study taking only one eye randomly among the bilateral cataracts. Patients with mixed and cortical cataract were combined into a single category representing "other" types. The nuclear cataract, PSC, and PP cataracts are considered as a single unit as well as reference category. The influences of risk factors on these two categories are compared with the later as a reference unit. Among the 115 patients, 79 (68.69%) were males and 36 (31.30%) were females. The mean age of the study group was  $39.46 \pm 3.15$  years [Table 1]. The study group consisted of manual laborers 40%, office goers 33.04%, and housewives 13.91%. Low socioeconomic group patients were 42.60%, middle-income group were 33.04%, and high-income group were 24.34%. Childbearing women were 11/36 (30.55%) as summarized in Table 1.

Different risk factors mentioned in the literature were observed in the patients of this study and tabulated in

Table 2. Family history was observed in 27.82% of the patients, atopy in 41.73%, trauma in 23.47%, exposure to UVL in 32.17%, uveitis in 25.21%, diabetes mellitus (DM) in 26.95%, renal disorders in 10.34%, myxedema in 06.08%, dehydration in 08.69%, glaucoma in 14.78%, hypertension in 33.04%, and usage of steroids in 25.21%. No risk factor mentioned above was elicited in 26.08% of the patients. Certain patients had more than one risk factor present in their case records [Table 2].

The present study showed that atopy was present in 48/115 patients accounting to 41.73% and remained the single risk factor which was most common followed by idiopathic 30/115 (26.08%). Atopy can be named as dominant risk factors because it was also associated with

other risk factors such as usage of steroids, DM, exposure UVL, glaucoma, and diabetes and UVL [Table 3]. The second most common type of cataract was in patients who were negative to all the risk factors hence named as idiopathic 30/115 (26.08%) patients [Table 3]. In this study, the most common type of cataract noted in atopy individuals was nuclear type in atopy individuals 17/48 (35.41%). Mixed type of cataract was next most common type 13/48 (27.08%), followed by subcapsular cataract 10/48 (20.83%) and PP 08 (16.66%), [Table 3]. Among the idiopathic group also, nuclear type of cataract was common in 11/30 (36.66%) patients followed by mixed type 08/30 (26.66%), [Table 3].

Atopy documented higher odds for nuclear cataract (35.41%) with  $P = 0.041$  ( $p$  significant at  $<0.05$ ), attaining statistical significance compared to other types. Steroids being the risk factor to cause cataracts were 25.21%, the  $P = 0.382$  which was statistically significant. For diabetes-induced cataracts, it was not significant with  $P = 0.610$ . Similarly, uveitis, glaucoma, renal disorders, and hypertension did not reach significant values as their  $P$  values were above 0.05. The idiopathic category showed increased odds for both nuclear and subcapsular cataracts with  $P = 0.026$  and  $0.032$ , respectively ( $P$  was statistically significant at  $<0.05$ ). UVL exposure attained statistical significance with  $P = 0.001$  with nuclear cataract and remained a high-risk factor [Table 3].

**Table 1: The demographic and anthropometric data in the early cataract study group (n=115)**

Observation	n (%)
The mean age	39.46±3.15
Gender	
Male	79 (68.69)
Female	36 (31.30)
Occupation	
Manual laborers	46 (40.00)
Office goers	53 (46.08)
Housewives	16 (13.91)
Mean height in feet	5.7±0.93
Mean weight in Kg	68.49±5.15
Socioeconomic groups	
Low	49 (42.60)
Middle	38 (33.04)
High	28 (24.34)
Childbearing-11	
Para 1-2	05 (45.45)
Para 2-3	03 (27.27)
Para 3-4	02 (18.18)
>4	01 (09.09)

**Table 2: The risk factors in the patients with early cataract (n=115)**

Risk factors	n (%)
Family history of early cataract	32 (27.82)
Atopy	48 (41.73)
Trauma	27 (23.47)
Exposure to UVL	37 (32.17)
Uveitis	29 (25.21)
Uveitis+steroids	21 (18.26)
DM	31 (26.95)
Renal disorders	12 (10.34)
Myxedema	07 (06.08)
Hypertension	38 (33.04)
Steroids	29 (25.21)
Dehydration	10 (08.69)
None (idiopathic)	30 (26.08)
Glaucoma	17 (14.78)
Glaucoma+UVL	09 (07.82)

UVL: Ultraviolet light, DM: Diabetes mellitus

## DISCUSSION

The present study is a retrospective, comparative cross-sectional study to analyze the risk factors found in young adults who developed cataracts. A case-control study in India showed a strong correlation between dehydration crises and early cataract formation.<sup>[22]</sup> Few studies have concluded that childbearing will increase the risk of cataract among women.<sup>[12]</sup> Few studies are done exclusively to observe the risk factors of cataract in early age groups.<sup>[12,19,20]</sup> In this context, an attempt was made by this study to review the risk factors in patients aged below 45 years. In the present study, multiple factors were observed in the young patients with cataract, and in few of them, more than one factor was present. In patients with multiple factors, certain factors were ignored as in very few patients the multiple factors with different combinations were present. In the present study, more than 40% of the patients had a history of atopy and proved by laboratory diagnosis. This is supported by many authors that atopy in the form of atopic dermatitis is associated with early cataract formation.<sup>[23-28]</sup> Even though the cause of atopic dermatitis is unknown, it was observed that cataract formation progresses during active dermatitis

**Table 3: The incidence of combination of risk factors in atopy individuals compared to idiopathic type (n=48, n=30)**

Observation	Nuclear (%)	PSC (%)	PP (%)	Mixed (%)	Total (%)
Idiopathic	11 (36.66)	06 (20.0)	05 (16.66)	08 (26.66)	30
Atopy alone	04 (44.44)	02 (22.22)	01 (11.11)	02 (22.22)	09
Atopy+steroids	03 (37.50)	02 (25)	01 (12.50)	02 (25)	08
Atopy+DM	04 (44.44)	02 (22.22)	01 (11.11)	02 (22.22)	09
Atopy with UV	03 (27.50)	01 (12.50)	02 (25.0)	02 (25.0)	08
Atopy with glaucoma	01 (20)	01 (20)	01 (20)	02 (40)	05
Atopy with DM and UVL	01 (25)	01 (25)	01 (25)	01 (25)	04
Atopy with UVL and steroids	01 (20)	01 (20)	01 (20)	02 (40)	05
Subtotal of cataracts with atopy	17 (35.41)	10 (20.83)	08 (16.66)	13 (27.08)	48

PSC: Posterior subcapsular, PP: Posterior polar, UVL: Ultraviolet light, DM: Diabetes mellitus

stage<sup>[24,25]</sup> and lens opacities are often associated with severe manifestations of this disease.<sup>[24,25]</sup> In a Japanese study, 12.4% of atopic dermatitis patients had early cataract.<sup>[23]</sup> In another study, authors observed 10–23% incidence of cataract with patients of atopic dermatitis.<sup>[29]</sup> Nuclear type of cataract was common in this study unlike the studies from other countries which showed a higher incidence of PSC (50%) and anterior subcapsular in 25%.<sup>[30,31]</sup> About 30 patients in the present study had no positive risk factors mentioned in their case records and labelled as idiopathic. Similar observations were made by Indian authors.<sup>[32]</sup> History of using steroids was present in 25.21% of patients in this study compared to other studies.<sup>[33]</sup> Using steroid in all its forms and more than 6 months usage was considered in this study as a risk factor. However, total dosage used proof of steroids usage by urine and blood examination was not possible as this was a retrospective study. Nuclear cataract was commonly seen in this category. History of DM was present in 26.95% of the total patients. PSC cataracts were observed in these patients and the finding was supported by few authors.<sup>[34-36]</sup> In the present study, UVL exposure was reported by 32.17% of the patients. UVL was reported as a risk factor in many of the studies.<sup>[4,37]</sup> The incidence of PSC cataracts was observed in patients with UVL exposure. The limitations of this study were that many factors even though recorded could not be confirmed with suitable tests as it was a retrospective study such as socioeconomic status, renal disorders, childbearing women, myxedema, hypertension, and dehydration.

## CONCLUSIONS

Atopy documented higher odds for nuclear cataract (35.41%) with  $P = 0.041$  ( $P$  significant at  $<0.05$ ), attaining statistical significance compared to other types. Steroids being the risk factor to cause cataracts was 25.21%, the  $P = 0.382$  which was statistically significant. For diabetes-induced cataracts, it was not statistically significant with  $P = 0.610$ . Risk factors for cataracts in younger age groups were atopy, steroids, and exposure to UVL. Idiopathic cataracts were the second most

common type in the study. The idiopathic category showed increased odds for both nuclear and subcapsular cataracts with  $P = 0.026$  and  $0.032$ , respectively ( $P$  was statistically significant at  $<0.05$ ).

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# Clinical Cross-sectional Study to Identify the Prevalence of Asymptomatic Bacteriuria in Type II Diabetic Patients at Rajiv Gandhi Institute of Medical Sciences Srikakulam

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## Abstract

**Background:** Diabetes mellitus is one of the common diseases affecting a large of population throughout the world. It is an endocrine disorder affecting the physical, psychological, and social health of an individual, WHO has defined diabetes as not merely but affecting a “state of complete physical, mental, and the social well-being.

**Materials and Methods:** Outpatients attending medicine Outpatient Department in Rajiv Gandhi Institute of Medical Science Srikakulam, were taken into this study to know the prevalence of asymptomatic bacteria (ASB) in Type II Diabetic patients and non-diabetic patients, i.e., taken 2 Groups (a). Group A: Positive for diabetic. (b) Group B: Negative for diabetic. 103 patients in the study population (Group A), 50 patients in control group (Group B), 50% of the sample size were taken for the control group.

**Results:** Out of 153 randomly selected patients 103 was found to be diabetic hence they recruited in the study group. Out of 103 patients, 58 (56.3%) were females, and 45 (43.7%) were males in the study population. All the patients were in age 30–80 years with an age of  $42 \pm 10.6$  years. Non-diabetic 50 patients were included in the control group who were in the age 75 years with mean age of  $48 \pm 8.9$  years. Control group consist of 28 (56%) male and 22(44%) females.

**Conclusion:** The incidence and prevalence of ASB are high in diabetic population compared to non-diabetic group. ASB is one of the important risk factors for renal complications in diabetic population. Diverse pathogenic microbial diaspora is responsible for ASB. Close monitoring of antibiotic sensitivity shall improve the control of ASB and thereby score over the risk reduction of renal complications in diabetic patients.

**Key words:** Culture, Gram stain, Microbiological, Microscopy

## INTRODUCTION

Diabetes mellitus is one of the common diseases affecting a large of population throughout the world. It is an endocrine disorder affecting the physical, psychological, and social health of an individual.

Urinary tract infection (UTI) is the most common infection in diabetic patients. Many UTI is asymptomatic and

whether symptomatic UTI is preceded by asymptomatic bacteriuria (ASB) is not known. In diabetic women, there is a four-fold propensity of UTI. ASB precedes symptomatic UTI in many occasions in Type 2 diabetes.

ASB is characterizes by the presence of significant amount  $>10^5$  CFU/ml of bacteria in urine.

Asymptomatic bacteria can lead to symptomatic urinary infection, as well as an increase in tendency for chronic kidney disease (CKD) and renal failure as one of the long-term adverse effect. Serious complications such as emphysematous pyelonephritis, renal papillary necrosis, and perinephric abscess. Diabetes with ASB is at risk for albuminuria.

The prevalence rate of ASB in diabetic women is 9–29% among females and 0.7–11% in males. The most common

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etiological agents in ASB are *Klebsiella pneumoniae*, *Escherichia coli*, *Enterobacter* Spp., *Streptococcus agalactiae*, *Enterococcus faecalis*, and coagulase-negative Staphylococci (CONS). *Streptococcus pyogenes* *E. coli* is the most common uropathogens among them.<sup>[1-10]</sup>

### Aim of the Study

- To identify the prevalence of ASB in Type II diabetics and non-diabetics.
- To know the bacterial profile of ASB.

## MATERIALS AND METHODS

### Design

Type II diabetic patients are attending at medicine OP in Rajiv Gandhi Institute of Medical Science Research Institute, Srikakulam, were randomly selected for the study based on the exclusion/inclusion criteria. It is a cross-sectional case-controlled study to know the prevalence of ASB in Type 2 patients, taken into two groups, namely, (1) positive for diabetic and (2) negative for diabetic.

### Study Period

The study period was 1 year.

### Inclusion Criteria

1. Patients with age >18 years or above.
2. Both sexes.
3. From random selection patients with type 2 diabetes mellitus with fasting > 126mg/dl included in a study group for sample size 103.
4. Similarly, from random selection patients with fasting blood sugar < 100mg/dl were included in the control group for sample size of 50.

### Exclusion Criteria

1. Pregnant women.
2. Recent catheterization.
3. Immunocompromised patients (HIV, malignancy, and long-term steroid therapy).
4. Recent hospitalization or undergone surgery within past 6 months or undergone any urogenital procedures.
5. Patients with fever, chills, and pain in abdomen were excluded from the study.

All type 2 diabetic patients with fasting blood sugar level >100 mg/dl but < 126 mg/dl all the non-diabetic patients were asked to collect clean-catch midstream urine sample and presence of pus cells, and pyuria was examined, and urine culture was done.

103 randomly selected study group patients and 50 randomly selected control group attending outpatients were of Rajiv Gandhi Institute of Medical Science Government General Hospital Srikakulam, who are above 18 years

of age were explained about the study and gave written consent to participate in the study.

### Laboratory Methods

The patients were instructed to clean their genital area with soap and water and to leave the first part of the urine and collect 10 ml of the clean catch midstream urine in sterile container. The urine samples were immediately transported to the laboratory and were processed immediately. In case of daily, the samples were stored in 4°C in refrigerator or preservative like boric acid were added. In addition to culturing; quantitative bacterial count, microscopic examination, and routine biochemical analysis for diabetic patients were done. Macroscopic analysis of urine samples was performed to describe the urine color, specific gravity, Ph. Glucose, protein, Ketone, red blood cells, etc.

### Biochemical Examination

24 h urine samples were collected to find the urine albumin level, excretion of urea, creatinine was done by Jaffe's method analysis in the Department of Biochemistry, MMCH & RI. 5 ml of blood was collected to test for the fasting, post-prandial glucose level, serum creatinine level, and blood lipid profiles such as high-dose cyclophosphamide, low-density lipoprotein (LDL), very LDL, and triglycerides level. Microalbuminuria, macroalbuminuria, and hemoglobin Alc were done using nephelometry analysis was done.

### Microbiological Examinations

#### Microscopy

Urine samples were centrifuged at 500 rpm/5 min. A wet mount and gram stain were done to detect the presence of >10 pus cells and bacteria. Presence of >10 polymorph nuclear leukocytes/HPF indicated inflammation of urinary Culture: Significant bacteriuria as assessed using standard loop technique ( $\geq 10^5$  CFU/ml).

The samples were streaked on various media such as nutrient agar, blood agar, MacConkey agar, and incubated at 37°C for 24.48 h and presence of visible colony formation was noted.

### Renal Complication

Ultrasound scanning was done to find any renal scars or renal damage. Two views anterior and posterior scan views were taken for finding the presence of cortical indentation, and focal or multiple defects either unilaterally or bilaterally was recorded as abnormal.

Normal albuminuria - urinary albumin to creatinine ratio (UACR) <30 mg/g.

Microalbuminuria - UACR 30–299 mg/g.

Macroalbuminuria - UACR 300 mg/g or more.

## RESULTS

Of the 103 type 2 diabetes patients 50 non diabetics subjects 58(56.3%) were females and 45 (43.7%) were males with age range between 30 and 80 years and in the between age of 42+/-10.6 years. Of the 50 non diabetics subjects 28(56%) were females and 22(44%) were males and with age range between 30 years to 80 years and were in the ages between 48+/- 8.9 years.

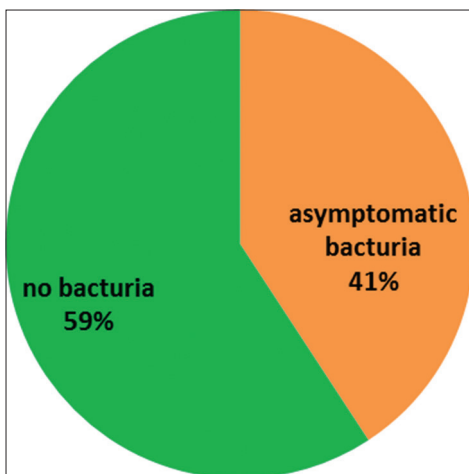
Out of 103 diabetic patients 42 (40.8%) were having asymptomatic bacteriuria and 4 of 50 non diabetic individuals were found to have asymptomatic bacteriuria ie 8%.

Of the 42 asymptomatic bacteriuria 27 (64.3%) were females and 15 (35.7%) were males. Of the 4 asymptomatic bacteriuria among non diabetic cases 3 (75%) were females and 1 (25%) were females).

The most common uropathogens isolated from the diabetic patients 16(38%) were having *E.coli*, 6(14.3%) *P.aeruginosa*, 4(9.5%) were *Acinetobacter*, 4(9.5%) were having *Proteus mirabilis*, 4(9.5%) were *P. vulgaris*, 3(7.1%) were *Citrobacter* spp. 3(7.1%) were *S. aureus* and 2(4.8%) were *Klebsiella* spp. Among the non diabetic individuals 2 (50%) were having *E.coli*, 1 (25%) *Klebsiella* spp. and *P. vulgaris* 1(25%) [Tables 1-3 and Graphs 1-3].

**Table 1: Age and gender wise distribution of studied subjects**

Age	Females(%)	Males(%)
31 to 40 years	14 (24.1)	9 (20)
41 to 50	28 (48.3)	21 (50)
51 to 60	5 (8.6)	4 (9.5)
61 to 70	7 (12.1)	9 (21.4)
71 to 80	4 (6.9)	2 (4.8)



**Graph 1: Distribution of studied population according to presence of ASB among type 2 diabetics (n=103)**

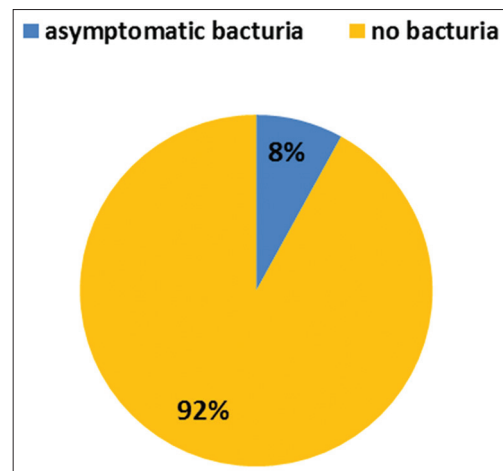
## DISCUSSION

The association of ASB with albuminuria and creatinine level has a significant correlation, which is concordant with our study, which also shows significant association of albuminuria ( $P < 0.001$ ) and serum creatinine ( $P < 0.001$ ) level in ASB. There was no correlation between age, body mass index (BMI) and ASB among the diabetic patients, which is similar to a study who also reported that there is no correlation between ASB with age and BMI of the patients.

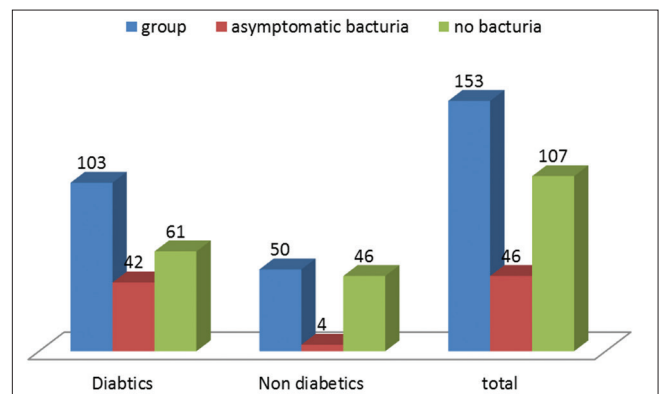
The mean glycemic level of diabetic patients at the time of inclusion into the study was  $>7.2 \pm 1.8$ .

It is suggested that ASB leads to increase in frequency of complications such as pyelonephritis, emphysematous cystitis, emphysematous pyelonephritis, perinephric abscess, renal papillary necrosis, and renal failure.

The rate of diabetic glomerulopathy prevalence was 10.7% and 4%, which need a renal biopsy to be performed.



**Graph 2: Distribution of studied population according to presence of ASB among non diabetics (n=50)**



**Graph 3: Distribution ASB among of studied subjects**



**Table 2: Various predisposing risk factors among studied individuals**

Factor	Type 2 diabetic group	Non diabetic individuals	Remarks
Age (years)	42±10.6	48± 8.9	
Glycemic control(%)	9.2±2.3	12.4±1.2	$P = 0.56$
BMI (kg/m <sup>2</sup> )	31±22.6	28.3±4.4	$P = 0.27$
S.creatinine (ia mol/lit)	85.4±22.6	79±19	$P < 0.001$
Urine Microalbumin	14	9	0.37
H/o UTI in previous years*	yes	yes	$P = 0.37$
H/o Smoking consumption as a habit*	yes	yes	$P = 0.01$
H/o Alcohol consumption as a habit*	yes	yes	$P = 0.21$

\*H/o (history of) particular indicator present in some but not all individuals of the studied population)

**Table 3: Prevalence of uropathogens among studied subjects**

Organism	Study group (n = 42) (%)	Control group (n = 4) (%)
E coli	16 (38)	2 (50)
P.aeruginosa	6 (14.3)	-
Acinobacter species	4 (9.5)	-
P.mirabilis	4 (9.5)	-
P.vulgaris	4 (9.5)	1 (25)
Citrobacter species	3 (3.7)	-
S.aureus	3 (3.7)	-
Klebsiella species	2 (4.8)	1 (25)

Patients with significant albuminuria UACR > 30 mg/g were main markers to diagnose glomerulopathy. Increased albumin excretions, inflammation of the Kidney are the associated factors leading to CKD in Type 2 diabetic patients. These results imply that damage to the kidney may be due to high incidence of recurrent ASB, which makes kidney vulnerable for bacterial infections which in turn decline the renal function.

## CONCLUSION

Out of 103 patients in the study group (Type 2 DM), 58 (56.3%) were females, and 45 (43.7%) were males in the study population in age 30–80 years with mean age of 42 ± 10.6 years. 50 control group patients 28 (56%) female and 22 (44%) males in the age 30–80 years with mean age of 48 ± 8.9 years.

- 42 (40.8%) had symptomatic bacteriuria consists of 26 (61.91%) male and 16 (38.09%) female in study population.
- In control group non-diabetic patients only 4 (8%) has asymptomatic with 3 (75%) were females and 1 (25%) were male patients.

- Nephropathy was diagnosed in 11 (10.7%) study population and 2 (4%) control patients. Neuropathy was seen in 4 (3.9%) study population and 1 (2%) in control group patients.

Most common uropathogen in study group (38%) and control group (50%) is *E. coli*.

Significant difference in serum creatinine values were found between control and study group.

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# Estimation of the Prevalence of Microalbuminuria in Non-Diabetic Patients with Coronary Artery Disease (CAD)

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## Abstract

**Background:** The new WHO report global atlas on cardiovascular disease prevention and control, September 19<sup>th</sup>, 2011, states that coronary artery disease (CAD) is the leading cause of death and disability in the world.

**Materials and Methods:** Sixty non-diabetics subjects of both sexes with CAD admitted as inpatients in Rajeev Gandhi Institute of Medical science Hospital and Research Institute in during the study period between May 2014 and July 2015 were included in the study.

**Results:** In this study, the prevalence of microalbuminuria among CAD patients without diabetes mellitus is 88.3% with high statistical significance in the age group of 30–60 years (40%), followed by more than 60 years (30%). 41–50 years (20%) and <40 years (10%). This suggests that CAD is more common after 50 years of age. The mean age is  $55.13 \pm 9.95$  years.

**Conclusion:** In this study, majority of subjects were males (78.3%) and 21.7% were females. This observation was statistically significant. 66.7% of CAD subjects had a positive family history of CAD. This observation was statistically significant. 58.3% smoking history. There was a significant association between smoking and microalbuminuria among CAD subjects in the study.

**Key words:** Hypertension, Obesity, Smoking

## INTRODUCTION

The new WHO report global atlas on cardiovascular disease (CVD) prevention and control, September 19<sup>th</sup>, 2011, states that coronary artery disease (CAD) is the leading cause of death and disability in the world.

Microalbuminuria may be a marker of generalized vascular disease, with arterial endothelial dysfunction being involved in the pathogenesis of atherothrombotic vascular disease.

Albumin is increasingly recognized as the earliest sign of vascular damage in both the kidney and the heart.

Microalbuminuria may be a marker of generalized vascular disease, with arterial endothelial dysfunction being involved in the pathogenesis of atherothrombotic vascular disease.

Studies have shown microalbuminuria that is positively associated with ischemic heart disease (IHD) in non-diabetic subjects and can be regarded as an important additional risk factor for IHD.

Microalbuminuria is an important cardiovascular and mortality risk factor, irrespective of diabetes or hypertension.

Smoking was associated with excessive urinary albumin excretion in hypertensive subjects.

Microalbuminuria seems to reflect a state of pathophysiologic vascular dysfunction that makes an individual susceptible to organ damage.<sup>[1-9]</sup>

## Aim of the Study

The aim of this study was as follows:

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1. To estimate the prevalence of microalbuminuria in non-diabetic patients with CAD
2. To study the association between microalbuminuria and other risk factors for CAD.

### Microalbuminuria

The urinary protein called albumin is increasingly recognized as the earliest sign of vascular damage in both the kidney and the heart.

Microalbuminuria abnormally high amounts of albumin in the urine is commonly thought of as an important risk factor for kidney disease. However, recently, studies have emerged highlighting microalbuminuria as an important, independent marker for endothelial dysfunction and CVD. Heightened awareness of microalbuminuria as an early prognostic indicator of CVD risk knowing when, how, and in whom to screen for it, and finally, owing the strategies to manage it are therefore essential prerequisites for cardiologists and other healthcare providers.

Microalbuminuria does not directly cause cardiovascular events; it serves as a marker for identifying those who may be at increased risk.

According to steno hypothesis, albuminuria might reflect a general vascular dysfunction and leakage of albumin and other plasma macromolecules such as low-density lipoproteins into the vessel wall that may lead to inflammatory responses and in turn start the atherosclerotic process.

### Microalbuminuria and Hypertension

1. In 1974, Parving *et al.* reported the finding of elevated urine albumin excretion levels in insufficiently treated essential hypertensives, which correlated significantly with blood pressure levels and fell after blood control.
2. Prevalence of an elevated urine albumin excretion increases with age and with longer duration and a higher severity of hypertension.
3. Hypertensive target organ damage is more common in microalbuminuria patients. In summary, microalbuminuria is an independent predictor of cardiovascular morbidity and mortality in both men and women with essential hypertension.
4. There is a positive link between high blood pressure and microalbuminuria.
5. Timed urine collection over 4 h or overnight.

### Inclusion Criteria

The following criteria were included in the study:

- CAD patients based on coronary angiogram.
- Both sexes.
- Non-diabetic patients.

## MATERIALS AND METHODS

### Design

This was a cross-sectional clinical study to estimate the prevalence of microalbuminuria in non-diabetic patients with CAD.

### Study Period

The study period was from May 2014 to July 2015.

### Sampling Procedure

The patients were given a container for a collection of urine over 24 h which was sent for the estimation of albumin level by immunoturbidimetry method. In-patients admitted and diagnosed to have CAD by Coronary angiogram were included in the study.

## RESULTS

Albuminuria has been identified as a life-threatening and cardiovascular renal risk profile. This important diagnostic parameter can not only predict renal or concurrent renal and cardiovascular adverse events in high-risk patients.

### Age Distribution

In this study, majority of subjects were in the age group of 51–60 years (40%), followed by >60 years (30%), 41–50 years (20%), and <40 years (10%). This suggests that CAD is more common after 50 years of age. There was a significant difference in proportions. The mean age is  $55.13 \pm 9.95$  years.

### Gender Distribution

In this study, majority of subjects were males (78.3%) and rest were females (21.7%).

### Family History of CAD

In this study, 66.7% of CAD subjects had a family history of CAD. There was no significant association between family H/O CAD and microalbuminuria among CAD subjects in the study.

### Smoking

In this study, 58.3% of subjects had a history of smoking, but there was no significant difference in proportions. There was a significant association between smoking and microalbuminuria among CAD subjects in the study.

### Body Mass Index (BMI)

There was no significant association between BMI and microalbuminuria among CAD subjects in the study. Odds ratio was 1.19, i.e., CAD subjects with BMI >23 are at 1.19 times higher risk for microalbuminuria than subjects

with BMI <23, but the risk was not statistically significant. Similar results were observed by the above-mentioned studies.

In this study, there was a significant association between hypertension and microalbuminuria among CAD subjects in the study. 69.8% of hypertensive subjects and 30.2% of normotensive subjects had microalbuminuria.

### Lipid Profile

In this study, there was no significant association between total cholesterol and microalbuminuria among CAD subjects in the study.

### Microalbuminuria and CAD

Prevalence of microalbuminuria among CAD patients without diabetes was 88.3%. This observation was highly statistically significant ( $P < 0.001$ ). Mean microalbumin levels was  $56.9 \pm 30.4$  mg.

In Danish Hospital a study done by Jensen J. S, Feldt-Rasmussen concluded microalbuminuria as an independent risk factor for IHD among hypertensive individuals who are non-diabetic.

## DISCUSSION

In this study, the prevalence of microalbuminuria among CAD patients without diabetes mellitus is 88.3% with high statistical significance. Mean urinary albumin excretion is  $56.9 \pm 30.4$  mg/24 h.

- Analyses of the association between the risk factors of CAD and microalbuminuria showed that risk factors such as smoking and hypertension have a statistically significant association with microalbuminuria (odds ratio is 10.74 and 32.38, respectively).
- Whereas the other risk factors of CAD like age, high BMI and dyslipidemia did not have any significant statistical association.
- The studies done by Deckert *et al.*<sup>[14]</sup> in large population using univariate and multivariate logistic regression analysis have shown that microalbuminuria is independently associated with increased cardiovascular risk factors and cardiovascular morbidity. Even in the present study, there is a strong association between microalbuminuria and CAD. However, microalbuminuria could not be established as an independent risk factor for

CAD since the study evaluated a lesser number of subjects.

- Microalbuminuria may therefore add value together with traditional risk indicators in diagnostic strategies.<sup>[3,10-14]</sup>

## CONCLUSION

This study recommends estimating urinary albumin excretion for 24 h to identify high-risk individuals for CAD and to add this laboratory workup as a tool for primary prevention of CAD.

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# A Clinical Study on 100 Cases of Herpes Zoster in a Tertiary Care Hospital

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## Abstract

**Introduction:** Herpes zoster is caused by varicella zoster virus (VZV), occurs as a result of reactivation of the dormant virus in sensory root ganglia. Most often VZV reactivates in the settings of relative immunologic compromise, as occurs with aging, or following disease such as HIV or various therapies, such as steroids, cancer chemotherapy, organ transplantation, and irradiation.

**Aim of the Study:** The study of herpes zoster was undertaken to find out the age and sex incidence, prevalence of prodromal symptoms, provocative factors, pattern of dermatomal involvement, prevalence of constitutional symptoms, association with HIV, other cutaneous diseases and systemic diseases, duration of time taken for resolution of lesions, and the prevalence of complications.

**Materials and Methods:** This study was conducted on 100 cases of herpes zoster. Patient's age, sex, occupation, and address were noted. A detailed history regarding the prodromal symptoms, skin lesions, nature of pain, duration of illness at the time of presentation, provocative factors, and history of chicken pox were recorded. Morphology of skin lesions, the side of involvement, cutaneous dissemination, mucosal lesions, and motor palsy associated with zoster were recorded. Associated cutaneous diseases, systemic diseases, and HIV infection were noted. The time taken for complete resolution of lesions and the complications were also noted.

**Observation and Results:** Out of 100 cases, 72 were males and 28 were females and the sex ratio was 2.5:1. Age wise distribution showed that 73 cases were below the age of 50 and 27 were above the age of 50 years. Prodromal symptoms were present in 85% and absent in 15% cases. Constitutional symptoms were present in 77% and 23% cases were not had any constitutional symptoms. Thoracic dermatome was the most common dermatome involved (60%) followed by cranial nerve zoster 14%, lumbar 13%, cervical 12%, and sacral dermatome 1% case. Most cases (85%) showed complete resolution of lesions between 10 and 21 days (2–3 weeks). Postherpetic neuralgia (PHN) was the most common complication observed in herpes zoster patients.

**Conclusion:** More than two-third (73%) of cases of zoster occurred in individuals below the age of 50 years. The prevalence of zoster was more in the younger age group when compared to elderly people. Male preponderance was found with the sex ratio of 2.5:1. Thoracic dermatome was the most common segment involved, and sacral was the least common dermatome affected. HIV infection was the most common provocative factor in 16% of total cases. The most common systemic diseases noted with zoster were diabetes mellitus and hypertension. Duration of time taken for resolution or healing of the lesions ranged from 2 to 4 weeks. PHN was the most common complication observed in our cases. The other complications noted were secondary bacterial infection, scarring, and motor palsy (facial palsy).

**Key words:** Dermatome, Herpes zoster, Postherpetic neuralgia, Varicella zoster virus

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## INTRODUCTION

Herpes zoster is also called as 'shingles' and the name is derived from a latin word 'cingulus' meanings 'girdle'. Herpes zoster is caused by varicella zoster virus (VZV), occurs as a result of reactivation of the dormant virus in sensory root ganglia following varicella. This concept was suggested by

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Garland in 1943. In 1958, Waller and colleagues established that there were neither biologic nor immunologic differences between the viral agents isolated from patients with chicken pox and Herpes zoster. Tyzzer described the histopathological descriptions of skin lesions resulting from VZV infections and noted the appearance of intranuclear inclusions and multinucleated giant cells. Cytodiagnosis of herpes zoster by smear taken from the base of a blister revealing multinucleated giant cells was introduced by Tzanck in 1947.

Hope-Simpson was the first to recognize the importance of the immune system in controlling the manifestations of zoster. He postulated that zoster resulted when humoral immunity to VZV wanes in years and decades after Varicella. Later, the importance of declining cellular rather than humoral immunity to VZV was recognized in the pathogenesis of zoster. Most often VZV reactivates in the settings of relative immunologic compromise, as occurs with ageing, or following disease such as HIV or various therapies, such as steroids, cancer chemotherapy, organ transplantation, and irradiation.

#### Aim of the Study

The study of herpes zoster was undertaken to find out the age incidence, sex incidence, prevalence of prodromal symptoms, provocative factors, prevalence of constitutional symptoms, pattern of dermatomal involvement, association with HIV, other cutaneous diseases and systemic diseases, duration of time taken for resolution of lesions, and the prevalence of complications.

## MATERIALS AND METHODS

This study was conducted on 100 cases of herpes zoster in a tertiary care hospital in South India. All cases of herpes zoster attending skin outpatient department and referred cases of zoster from other departments were studied.

Patient's age, sex, occupation, and address were noted. A detailed history regarding the prodromal symptoms, skin lesions, nature of pain, provocative factors, and history of varicella were taken. Associated cutaneous diseases, systemic diseases, and HIV infection were recorded.

Each patient underwent detailed general and systemic examinations. Morphology of skin lesions, the side of involvement, cutaneous dissemination, mucosal lesions, motor palsy associated with zoster, other systemic and cutaneous diseases were recorded.

A set of laboratory investigation consisting of complete hemogram, blood sugar, renal function test, urine analysis, enzyme-linked immunosorbent assay for HIV antibody was done in all cases.

Patients were treated with oral acyclovir, and they were assessed with regard to the course of the disease, time is taken for resolution of lesions and for persistent pain and other complications.

## OBSERVATION AND RESULTS

Out of 100 cases, 72 were males and 28 were females and the sex ratio was 2.5:1. Age wise distribution showed that 73 cases were below the age of 50 and 27 were above the age of 50 years. Maximum number of cases were seen between the age group of 41–50 years (25%) and 21–30 years (24%) which was followed by 31–40 years (14%) and 61–70 years (14%). Minimum number of cases was observed in the age group of 1–10 years (1%), 71–80 years (1%), and 81–90 years (1%). The youngest was 9 years and oldest was 81 years of age [Table 1].

Prodromal symptoms were present in 85 cases (85%) and absent in 15 (15%) cases. Among the 85 cases, pain in the dermatome was the most common symptom in the pre-eruptive stage [Table 2].

Constitutional symptoms were present in 77 cases (77%) and 23 (23%) cases were not had any constitutional symptoms. Fever was the most common constitutional symptom present in 45 (58.44%) cases. Other constitutional symptoms noted were myalgia 18 (23.37%), headache 12 (15.58%), and joint pain in 2 (2.59%) cases.

**Table 1: Age- and sex-wise prevalence of herpes zoster cases**

Age group	Male	Female	Total number of cases (%)
1–10	Nil	1	1 (1)
11–20	6	3	9 (9)
21–30	17	8	25 (25)
31–40	12	2	14 (14)
41–50	18	6	24 (24)
51–60	6	5	11 (11)
61–70	11	3	14 (14)
71–80	1	-	1 (1)
81–90	1	-	1 (1)
Total	72	28	100

**Table 2: Prevalence of signs and symptoms in pre-eruptive stage**

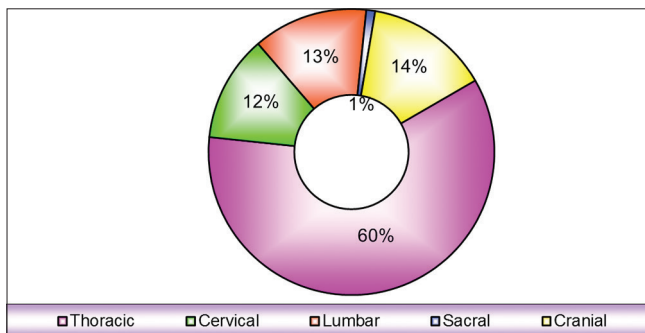
Signs and symptoms	Total number of cases (%)
Pain in the dermatome	65 (76.47)
Burning sensation	10 (11.76)
Itching	4 (4.70)
Tingling, numbness, paresthesia	4 (4.70)
Erythema	2 (2.35)
Total cases	85

Out of 100 cases, 90% gave definite history of occurrence of varicella in the past. The remaining 10% of cases were not aware of the occurrence of chicken pox in their childhood period.

The most common morphological pattern of lesion seen was grouped vesicles in a dermatomal distribution



**Figure 1:** (a) Herpes zoster involving maxillary division of trigeminal nerve, (b) herpes zoster ophthalmicus with Hutchinson's sign, (c) necrotic ulcer in HIV positive case, (d) cervical dermatome involvement, (e) sacral dermatome zoster, (f) thoracic dermatomal zoster



**Figure 2:** Pattern of dermatome involvement



**Figure 3:** (a) Complication of zoster with scarring, (b) keloid formation after zoster, (c) secondary bacterial infection and ulceration in zoster, (d and e) herpes zoster with dissemination, (f) herpes zoster oticus with facial palsy

in 97 (97%) cases. The remaining 3 (3%) cases had crusting and erosion in dermatomal pattern [Figure 1]. Thoracic dermatome was the most common dermatome involved (60%) followed by cranial nerve zoster 14% of cases, lumbar 13% of cases, cervical 12% of cases, and sacral dermatome 1 (1%) case [Figure 2]. The pattern of dermatome involvement was almost similar in both sexes. The distribution of lesions was more on the left side (52%) when compared to the right side (48%).

Out of 100 cases, 97% of cases had involvement of single dermatome, and 1% of case had multidermatomal involvement, and the remaining 2% of cases had cutaneous dissemination in addition to the classical dermatomal distribution [Figure 3d and e]. Among the 2 cases with cutaneous dissemination, 1 case was a HIV positive patient.

In our study population, 36 cases had provocative factors for development of herpes zoster. Among the 36 cases, 16 cases (44.4%) were having HIV infection, 7 cases (19.4%) were associated with diabetes and 6 cases (16.6%) were on steroid therapy for systemic lupus erythematosus (SLE) (3 cases), bronchial asthma (2 cases), and lepra reaction (1 case). The other provocative factors are illustrated in Table 3.

Cutaneous diseases seen in association with herpes zoster were acne (1 case), seborrheic dermatitis (2 cases), tinea versicolor (2 cases), Hansen's disease (1 case), insect bite allergy (2 cases), wart (1 case), cellulitis (1 case), oral candidiasis (1 case), tinea cruris (1 case), and intertrigo (1 case).

Diabetes (7 cases) and hypertension (6 cases) were the most common systemic diseases seen in association with herpes zoster. Other systemic diseases seen with herpes zoster were SLE (3 cases), bronchial asthma (2 cases), tuberculosis (1 case), hepatitis B (1 case), and chronic renal failure (1 case).

In this study, 16 cases were found to be HIV positive. Among the 16 HIV positive cases, 14 were males and 2 were females. In these 16 cases, 10 patients were already diagnosed as HIV positive and 6 cases were screened and turned out to be positive after the occurrence of zoster.

**Table 3: Prevalence of provocative factors**

Provocative factors	Male	Female	Total (%)
HIV	14	2	16 (44.4)
Physical stress (parturition)	0	1	1 (2.7)
Diabetes	6	1	7 (19.4)
Renal transplantation	1	0	1 (2.7)
Steroid therapy	3	3	6 (16.6)
Pulmonary tuberculosis	1	0	1 (2.7)
Pregnancy	0	1	1 (2.7)
Radiotherapy	0	2	2 (5.5)
Malignancy (prostate cancer)	1	0	1 (2.7)
Total	26	10	36



Following treatment with oral acyclovir, most cases (85%) showed complete resolution of lesions between 10 and 21 days (2–3 weeks) and the remaining 15% cases showed resolution after the 3<sup>rd</sup> week [Table 4].

Postherpetic neuralgia (PHN) was the most common complication in 19 cases (47.5%) [Figure 4]. Among the

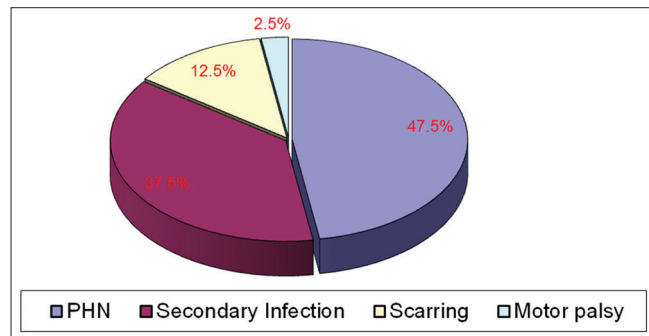
**Table 4: Resolution time of zoster lesions**

Duration	Number of cases (%)
10–14 days (2 <sup>nd</sup> week)	35 (35)
15–21 days (3 <sup>rd</sup> week)	50 (50)
22–28 days (4 <sup>th</sup> week)	14 (14)
29 days and above (5 <sup>th</sup> week and above)	1 (1)

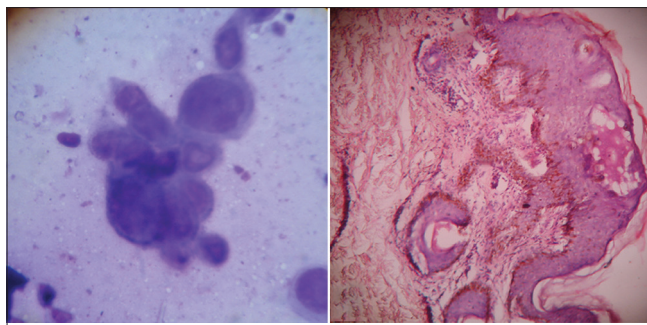
**Table 5: Age group wise occurrence of PHN**

Age (years)	Male	Female	Total (%)
10–20	0	1	1 (5.3)
21–30	1	0	1 (5.3)
31–40	0	0	0
41–50	4	2	6 (31.5)
51–60	3	0	3 (15.7)
61–70	5	2	7 (36.8)
71–80	0	0	0
81–90	1	0	1 (5.3)
Total	14	5	19 (100)

PHN: Postherpetic neuralgia



**Figure 4: Prevalence of complications**



**Figure 5: (a) Tzanck smear from a zoster lesion showing multinucleated giant epithelial cell, (b) skin biopsy showing intraepidermal blister formation with ballooning degeneration (H and E, x10)**

19 cases of PHN, 14 were male and 5 cases were female. The highest prevalence of PHN (36.8%) was noted in the age group of 61–70 years which was followed by 31.5% in the age group of 41–50 years and 15.7% in the age group of 51–60 years. Minimum number of cases with PHN were observed in the groups of 10–20 years (5.3%), 21–30 years of age (5.3%), and 81–90 years (5.3%) [Table 5]. Out of 19 cases of PHN, 4 cases had spasmodic shooting pain, 2 cases had allodynia, and the remaining 13 cases had burning type of pain.

Other complications observed were secondary bacterial infection in 15 cases (37.5%) [Figure 3c], scarring in 5 cases (12.5%) [Figure 3a], of which 1 case had keloid [Figure 3b], and facial palsy was seen in one case (2.5%) of Ramsay Hunt Syndrome with underlying prostatic carcinoma [Figure 3f]. Recurrence of herpes zoster and systemic complications were not observed in our study population.

Tzanck smear from the vesicle showed multinucleated giant epithelial cell [Figure 5a]. Skin biopsy was done in a case of zoster showed intraepidermal vesicle with reticular degeneration and ballooning degeneration in the epidermis. The dermis showed marked inflammatory infiltrate around the blood vessels and upper dermis [Figure 5b].

## DISCUSSION

Herpes zoster is common among immunocompromised persons, so the elderly are at particular risk because immunocompetence declines with age. Whitley<sup>[1]</sup> reported that zoster affects 20% of general population during their lifetime, especially in elderly. This study of 100 patients with herpes zoster revealed that the majority of the patients affected were adults in the second (25%), third (14%), and fourth (24%) decades. More than two-thirds (73%) of the reported cases occurred in individuals below the age of 50 and the remaining (27%) affected cases were above 50 years of age. This is in contrast to the observation made earlier in other studies wherein more than two-third of cases wherein the age group of above 50 years with the highest incidence among individuals in the sixth to eighth decades of life.<sup>[2]</sup> Total number of cases in childhood and adolescence age group were 10 cases.

In this study male: Female ratio was 2.5:1 which is in contrast with the western studies where female predominance have been reported.<sup>[3,4]</sup>

Prodromal symptoms were in a higher rate (85%) in this study. In majority of cases, pain in the dermatome was the most common symptom in the pre-eruptive stage. This is in contrast to the lower incidence of prodromal symptoms in various other studies.<sup>[5]</sup>



Constitutional symptoms were noted in 77% of cases in our study population, and majority of cases were in younger age group which is in contrast to a South Indian study by Pavithran and Abdul Latheef<sup>[5]</sup> where more number of patients with constitutional symptoms were in elderly age group. Fever was the most common constitutional symptom observed in this study.

About 90% of the study population had varicella in the past, and 10% of cases were not aware of the occurrence of varicella. A study was conducted by Yawn *et al.* showed that people who had chicken pox have 30% risk of acquiring herpes zoster in their lifetime.<sup>[6]</sup>

In this study, 97% of cases had classical herpes zoster in dermatomal pattern<sup>[2]</sup> and 3% of cases had crusting and erosions along the dermatome. Thoracic dermatome was the most common dermatome involved (60%) in this study followed by cranial nerve involvement (14%) which is similar to the study by Pavithran and Abdul Latheef.<sup>[5]</sup> The other frequently involved dermatomes were lumbar dermatome in 13%, cervical (12%) in accordance with the literature reports.<sup>[7]</sup> The least common dermatome involved was sacral segment (1%).

Out of 100 cases, 97% of cases had involvement of single dermatome and 1% of case had multidermatomal involvement, and the remaining 2% of cases had cutaneous dissemination. Disseminated herpes zoster is defined as the presence of more than 20 vesicles away from the primary dermatome and adjacent dermatome. Among the 2 cases of disseminated zoster, 1 was associated with HIV infection. In a study conducted by Gebo *et al.*, none of the cases of disseminated zoster were associated with HIV infection.<sup>[8]</sup> Literature says that the prevalence of cutaneous dissemination was 40% in HIV positive cases with zoster.<sup>[9]</sup> Multidermatomal zoster case with Ramsay Hunt Syndrome was associated with malignancy in our study.

Among the 100 cases, 36 cases were having one or more provocative factors. Out of 36 cases, the most common risk factor seen was HIV infection in 16 cases (44.4%) followed by diabetes in 7 cases (19.4%), steroid therapy in 6 cases (16.6%), and radiotherapy 2 cases (5.5%).

Malignancy, tuberculosis, renal transplantation, physical stress of parturition and pregnancy were also noted as provocative factors with 1 case in each. Depressed cell-mediated immunity associated with most of the above-mentioned conditions, as described in literature<sup>[10]</sup> could be the possible factor for the development of zoster.

Cutaneous diseases seen in association with herpes zoster were acne, seborrheic dermatitis, tinea versicolor,

Hansen's disease, insect bite allergy, wart, cellulitis, oral candidiasis, tinea cruris, and intertrigo. The association of zoster with these skin diseases may be coincidental.

Systemic diseases seen in association with herpes zoster were diabetes mellitus 7 cases, hypertension 6 cases, SLE 3 cases, bronchial asthma 2 cases, tuberculosis 1 case, hepatitis B infection 1 case, and chronic renal failure 1 case. Immunosuppression associated with diabetes, tuberculosis and steroid therapy of SLE and bronchial asthma could have triggered zoster in these cases.

In this study, 16% of cases were HIV seropositive which is higher than the study by Kar and Ramasastry<sup>[11]</sup> where it was 9.5%. Among the 16% of cases of HIV positivity, 10% cases developed herpes zoster during the course of HIV infection and herpes zoster was the initial manifestation of HIV infection in 6% cases. Herpes zoster is an important indicator of HIV infection<sup>[12]</sup> as it has been included in HIV Stage 2 marker in the WHO staging. Extensive tissue necrosis and secondary bacterial infection were seen in HIV positive individuals with herpes zoster in our study.

Period of time taken for resolution or healing of the lesions in most of the cases ranged from 2 to 4 weeks as described in literature.<sup>[5]</sup> PHN was the most common complication noted in 19 patients (47.5%) followed by secondary bacterial infection in 15 cases (37.5%), scarring in 5 cases (12.5%), and motor zoster (facial palsy) in 1 case (2.5%). PHN is the most common complication reported in the literature.<sup>[5]</sup> In accordance with the literature reports,<sup>[5]</sup> the incidence of PHN increased with increasing age in this study. The complications were maximum in those cases came for treatment late in the course of the disease.

## CONCLUSION

In this study population, herpes zoster mainly occurred in second, third, and fourth decades of life. More than two-third (73%) of cases occurred in individuals below the age of 50 years. Male preponderance was found with the sex ratio of 2.5:1. Prodromal symptoms were present in 85% of patients and pain in the dermatome was the most common prodromal symptom noted. Thoracic dermatome was the most common segment involved, and sacral was the least common dermatome affected in the cases studied. HIV infection was the most common provocative factor in 16% of total cases. Out of this, 10% of cases were already diagnosed as HIV positive and developed herpes zoster during the course of HIV disease and herpes zoster was the initial manifestation of HIV infection in 6% of cases. This indicates the importance of HIV testing in patients presenting with herpes zoster, especially with

necrotic ulceration, dissemination and in the younger age group patients. Steroid therapy given for certain systemic disorders and decreased cell-mediated immunity acted as a triggering factor for herpes zoster in some cases. The most common systemic diseases noted with zoster were diabetes mellitus, hypertension and the association of zoster with hypertension was considered coincidental. Duration of time taken for resolution of the lesions ranged from 2 to 4 weeks. PHN was the most common complication observed in our cases, and the incidence of PHN increased with increasing age. The other complications noted were secondary bacterial infection, scarring and motor palsy (facial palsy) along with herpes zoster. The prevalence of zoster was more in the younger age group when compared to elderly people in this study. From our study, we conclude that HIV screening should be done in all cases of herpes zoster and the antiviral therapy should be initiated as early as possible to reduce complications herpes zoster.

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# A Hospital Based Clinical Study on Primary Open Angle Glaucoma

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## Abstract

**Background:** Primary open angle glaucoma (POAG) is defined as a chronic optic neuropathy with its characteristic optic disc changes and corresponding visual field defects resulting from increased intraocular pressure (IOP) which is the only treatable risk factor. It is one of the irreversible causes of blindness in the world and hence requires early diagnosis which is not a simple task.

**Aim of the Study:** The aim of the study was to conduct a clinical study on POAG and the associated risk factors in a hospital based set up.

**Materials and Methods:** A total of 64 adult patients aged above 45 years with subjects aged 40 years with complaints of raised intraocular pressure were included in the study. Complete ophthalmic examination was done. Diagnosis of POAG established according to the International Society of Geographical and Epidemiologic Ophthalmology classification.

**Observations and Results:** Among 64 patients 31 (48.43%) were males and 33 (51.56%) were females with a male to female ratio of 1:1.06. The mean age was  $54.84 \pm 3.10$ . The mean body mass index was 25.66. Family history was positive in 43/64 (67.18%) patients. 43/64 (32.80%) patients were from urban areas and 21/64 were from rural areas. Hypertension was present in 48.43% of the patients. The mean IOP was  $14.79 \pm 3.60$  mmHg. The mean central corneal thickness (CCT) was  $502.80 \pm 35.30$   $\mu$ m. The mean vertical cup-to-disc ratio (VCDR) was  $0.38 \pm 0.16$  with odds ratio of 0.7 and 95% confidence interval (CI) was 0.3–0.9. The lens opacities measured with Lens Opacities Classification System II system; Category II were 10/64 (15.62%) patients, and Category III in 24 (37.50%), and Category III in 30 (46.87%) patients.

**Conclusions:** The prevalence of POAG in this population was 1.62%. The prevalence was more in 50–60 years age group. The risk factors were raised IOP, hypertension, urbanization, and increasing age. The values of CCT, VCDR, and depth of anterior chamber, angle between iris and trabeculae and lens opacities help in the categorization of POAG and assessing the prognosis.

**Key words:** Anterior synechiae, Gonimetry, Intraocular pressure, Primary open angle glaucoma, Optic disc

## INTRODUCTION

Glaucoma is the second most leading cause of visual loss in the world.<sup>[1]</sup> Scientific studies undertaken in South India showed various prevalence rates of primary open-angle glaucoma (POAG).<sup>[2-4]</sup> The Vellore eye survey<sup>[2]</sup> reported a prevalence of 0.41% for POAG in the 30–60 years age group, whereas the Andhra Pradesh eye diseases study<sup>[3]</sup> estimated the prevalence of POAG in

the urban population to be 2.56% in those aged 40 years and older. The International Society of Geographical and Epidemiologic Ophthalmology suggested a new classification for the diagnosis of glaucoma on the grounds of both structural and functional evidence of glaucomatous optic neuropathy.<sup>[5]</sup> The three types described are (1) primary angle closure suspect (PACS): Eye where  $>180^\circ$  of posterior trabecular meshwork is not visible on gonioscopy; (2) PAC: PACS with peripheral anterior synechiae (PAS); and (3) PAC glaucoma (PACG): PACS with glaucoma as defined above. The Vellore study PACG as acute or chronic<sup>[2]</sup> and was appositional (with raised IOP) or synechiae (with PAS). Glaucomatous disc or visual fields were not mandatory for the diagnosis of angle closure glaucoma.<sup>[2]</sup> Review of the western literature showed the risk factors associated with glaucoma were

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high intraocular pressure (IOP), low blood pressure, low ocular perfusion pressure, narrow anterior chamber angles, thin corneas, pseudoexfoliation, a low body mass index (BMI), and myopia. These factors were examined in separate investigations so that interdependencies between some of the parameters could not be addressed. Most of these studies were performed in urbanized regions.<sup>[6-9]</sup> The present study is a prospective clinical study on POAG and the associated risk factors in a hospital based set up.

### Type of Study

This was a prospective cross-sectional study.

### Study Period

The study was from April 2004 to March 2006.

### Institute of Study

This study was conducted at Government General Hospital attached to Kurnool Medical College, Kurnool, Andhra Pradesh.

## MATERIALS AND METHODS

Among the outpatients attending the Department of Ophthalmology, Kurnool Medical College Hospital, 64 patients with diminished vision, raised IOP and altered visual fields were selected randomly to include in this study. An Institutional Ethical Committee clearance was obtained before commencing the study, and an Institutional Ethical Committee approved consent form was used for the study.

### Inclusion Criteria

(1) Patients aged above 40 years, (2) patients with visual disturbances and headache, (3) patients with raised IOP, (4) patients with abnormal visual fields, and (5) patients with hypertension were included.

### Exclusion Criteria

(1) Patients below 40 years, (2) patients with a history of ocular surgery, (3) patients with acute symptoms of glaucoma, and (4) patients with closed angle glaucoma were excluded. All the patients were elicited of history about the impairment of vision. Demographic data of the patients were collected. All the patients were subjected to total ophthalmological examination including slit lamp examination, visual acuity; intraocular pressure measurement, corneal pachymetry, streak retinoscopy, and subjective refraction were conducted. Refraction data are based on subjective refraction values. Emmetropia was defined as a spherical equivalent between  $-0.50$  DS and  $+0.50$  DS. Myopia was defined as spherical equivalent  $<-0.50$  DS and hyperopia as spherical equivalent  $>+0.50$  DS. Visual fields with no depressed points to any level of sensitivity were considered to be normal.

The central corneal thickness (CCT) was measured with the ultrasonic pachymeter before any contact procedure or pupillary dilation. Slit lamp biomicroscopy was performed, and peripheral anterior chamber depth was graded according to the Van Herick system.<sup>[10]</sup> IOP was recorded with a Goldmann applanation tonometer with the patient under topical anesthesia induced by xylocaine 4%. Gonioscopy was performed on all subjects in dim ambient illumination with a shortened slit that does not fall on the pupil. The angle was graded according to the Shaffer system.<sup>[8]</sup> Grading of lens opacification was performed at the slit lamp using the Lens Opacities Classification System II (LOCS II)<sup>[11]</sup> with a minimum pupillary dilation of 6 mm. Stereoscopic evaluation of the optic nerve head was performed with a  $+78$ -D lens at the slit lamp. The vertical and horizontal cup-to-disc ratios (CDRs) were measured and recorded. The presence of any notching, splinter hemorrhages, and peripapillary atrophy was documented. A detailed retinal examination was performed using a binocular indirect ophthalmoscope and a  $+20$ -D lens. A provisional diagnosis of suspected glaucoma was made when the subject had one or more of the following conditions: IOP  $\geq 21$  mmHg in either eye; vertical CDR (VCDR)  $\geq 0.7$  in either eye or CDR asymmetry  $\geq 0.2$ ; and focal thinning, notching, or a splinter hemorrhage. All the data collected were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

Among the 64 patients, 31 (48.43%) were males and 33 (51.56%) were females with a male to female ratio of 1:1.06. Patients aged above 40 years were included. The youngest patient was 40-year-old and the eldest was 73 with a mean age of  $54.84 \pm 3.10$ . The mean BMI, the presence of family history, distribution between urban and rural background, and history of hypertension are shown in Table 1. The mean basal metabolic rate was 25.66 which were higher than the standards of the age groups. Family history of glaucoma was observed in 43/64 (67.18%) of the total patients in the study. 43/64 (32.80%) patients were living in urban areas and 21/64 were living in rural areas. Hypertension was present in 48.43% of the patients [Table 1]. The most common age group in the study with POAG was 50–60 years 23/64 (35.93%), followed by 19/64 (29.68%) in the 40–50 years age group [Table 1].

Table 2 summarizes the distribution of glaucoma cases according to the gender with odds ratio and 95% of confidence of intervals values. The mean IOP was  $14.79 \pm 3.60$  mmHg, with the 97.5<sup>th</sup> and 99.5<sup>th</sup> percentiles being 21 and 26 mmHg, respectively. The IOP values observed in



**Table 1: Demographic data and clinical history (n-64)**

Age groups	Males-31 number and %	Females-33 number and %	Mean BMI	Family history	Urban	Rural	Hypertension
40–50–19	09	10	24.14	11/19	13/19	06/19	08/19
50–60–23	11	12	27.05	19/23	16/23	07/23	13/23
60–70–15	08	07	26.38	09/15	09/15	06/15	07/15
>70–07	03	04	25.10	04/07	05/07	02/07	03/07
Percentage			25.66	67.18%	67.18	32.80	48.43

**Table 2: The incidence of multiple risk factors for POAG in the study (n-64)**

Variable	Number	Odds ratio	95% CI
Age in years			
40–50	19	1.00	
50–60	23	2.56	1.10–4.96
60–70	15	4.25	1.86–7.98
>70	07	5.18	2.24–9.54
Gender			
Male	31	1.00	
Female	33	0.98	0.53–1.42
IOP	14.79±3.60	1.00	21–26
CCT	502.8±35.3 µm	1.16	0.95–1.60
Emmetropia	05		
Myopia	44	0.68	0.40–1.16
Hypermetropia	20	1.00	
Hypertension			
Present	31	1.04	0.65–1.84
Absent	33	1.00	
Mean VCDR	0.38±0.16	0.7	0.3–0.9
Anterior chamber depth			
Van Herick grading			
Grade 3	37 (57.81%)		
Grade 4	27 (42.18%)	-	-
Shaffer grading			
Angle between iris and trabecular mesh		-	-
20–30°	16 (19.04%)		
30–40°	27 (42.18%)		
45°	21 (32.81%)		
LOCS II categories			
II	10 (15.62%)	-	-
III	24 (37.50%)		
IV	30 (46.87%)		

POAG: Primary open angle glaucoma, IOP: Intraocular pressure, CCT: Central corneal thickness, CI: Confidence interval, VCDR: Vertical cup-to-disc ratio, LOCS II: Lens Opacities Classification System II

these patients was found to be higher than normal standard values for that age group. The mean CCT was 502.80 ± 35.30 µm in the study group patients. The values of IOP and CCT were correlated and found that in patients with higher IOP the thickness of cornea was higher irrespective of the age groups. 5/64 patients were emmetropic, 44/64 were myopic, and 20/64 were hypermetropic patients in this study. Hypertension was present in 31/64 patients in the study. 31/64 (48.43%) patients were myopic and 20/64 (31.25%) patients were hypermetropic [Table 2]. The mean VCDR was 0.38 ± 0.16 with an odds ratio of 0.7 and 95% CI was 0.3–0.9. Van Herick grading of anterior chamber depth grading was Grade 3 in 37/64 (57.81%) and Grade 4 in 27/64 (42.18%) patients. Shaffer grading

of the angle between iris and trabeculae was 20–30° in 16/64 (25.00%) patients, 30–40° in 27 (42.18%) patients, and 45° in 21/64 (32.81%) patients [Table 2]. Lens opacities were measured using LOC II system and Category II was found in 10/64 (15.62%) patients, Category II in 24 (37.50%), and Category IV in 30 (46.87%) patients.

## DISCUSSION

In this study, the prevalence of POAG was 2.38% among all the ophthalmic patients attending the tertiary teaching hospital where this study was conducted. Out of 64 patients POAG, 96.34% of the patients were not diagnosed before attending the hospital but had IOP of ≤22 mmHg at the examination. The overall rates of high IOP associated with POAG were similar to the studies conducted by Dandona *et al.*<sup>[3]</sup> and Ramakrishnan *et al.*<sup>[4]</sup> The rates of angle closure are similar to those reported by investigators from India who used a Goldmann two-mirror lens for classification.<sup>[2]</sup> Review of literature shows the prevalence of POAG among the black races ranges from 4.2% to 8.8%.<sup>[12,13]</sup> In white race populations, the prevalence rates were 1.1–3%.<sup>[14–16]</sup> Prevalence for East Asia varies from 0.5% to 2.3%.<sup>[17]</sup> The reported prevalence of POAG in India is between 0.41% and 2.56%.<sup>[2–4]</sup> This study and other studies<sup>[3,4]</sup> have shown that most people with POAG could have a presenting IOP ≤21 mmHg. Different criteria were used in different studies to diagnose glaucoma. Dandona *et al.*<sup>[3]</sup> used a combination of disc changes, IOP ≥22 mmHg, and IOP asymmetry of 6 mmHg as the criteria for advising the participant to undergo visual field examination. The inclusion of pseudoexfoliation glaucoma along with POAG in this study may explain the higher prevalence of glaucoma. In this study, the mean VCDR was 0.38 ± 0.16. In the study by Dandona *et al.* a visual field defect that corresponded to disc findings (a CDR of ≥0.8, asymmetry >0.2, or thinnest neuroretinal rim width of 0.2) was used for diagnosis in 70.3% of their cases. Results from several studies have shown that the prevalence of POAG increases with age.<sup>[16,17]</sup> In this study, the most common age group in the study with POAG was 50–60 years 23/64 (35.93%), followed by 19/64 (29.68%) in the 40–50 years age. Some studies have shown a higher prevalence of POAG in men.<sup>[4,18]</sup> Other studies have shown no gender difference

in POAG prevalence.<sup>[3,15]</sup> In this study, even though the incidence of POAG was more in women but it was not statistically significant. The rate of undiagnosed POAG in the study by Dandona *et al.*<sup>[3]</sup> was 92.6%. In this study, the number patients with undiagnosed POAG were 96.34%. This may be due to the lack of facilities for comprehensive ophthalmic examination for the Indian population or to the widespread use of inappropriate eye examination techniques. In the present study, 46/64 (71.87%) of the patients presented with IOP of >21 mmHg, possibly because of taking only a single reading while recording the IOP measurement for the analysis. Although a presenting IOP >21 mmHg is associated with a higher risk of the development of glaucoma, the remaining patients with POAG had IOPs of <21 mmHg. The rate of prevalence of POAG still increased with increasing IOP, however, and the mean IOP of subjects with POAG was more than that of the overall study population. These findings are similar to the other study reports.<sup>[3,4]</sup> Our results reconfirm that the diagnosis of POAG cannot be based only on the level of IOP, but higher IOP is an important risk factor for POAG. In this study, the prevalence of blindness due to POAG was found to be lower than that in the other two studies.<sup>[3,4]</sup> None of the patients in the present study presented with total blindness. 8/64 patients had a vision <2/40; because visual field testing was not possible in these subjects and they did not have total glaucomatous optic atrophy. Some studies have shown diabetes as a risk factor for POAG.<sup>[19,20]</sup> The Baltimore eye survey<sup>[21]</sup> 26 has shown no relationship between diabetes and POAG. In this study, none of the patients had diabetes mellitus. Some studies have shown an association between systemic hypertension and POAG<sup>[21,22]</sup> whereas others have not.<sup>[23]</sup> In this study, 31/64 (48.43%) patients of POAG presented with a diagnosis of hypertension. Myopia was observed in 44/64 patients with refractory error <-0.5 spherical equivalent. Patients with POAG in the Rotterdam Study 30 were reported to have significantly thinner CCT than were the control subjects. In the Barbados eye studies, 31 the participants with POAG had thinner corneas ( $520.6 \pm 37.7 \mu\text{m}$ ) than those classified having no glaucoma ( $530.0 \pm 37.7 \mu\text{m}$ ). In this study, the mean CCT in subjects with POAG was  $502.8 \pm 35.3 \mu\text{m}$  and not significantly different from that of the normal study population. Within the POAG group, however, subjects with an IOP >21 mmHg had thicker corneas than did the subjects with an IOP  $\leq 21$  mmHg, but the difference was not statistically significant. The mean VCDR in subjects with POAG with IOP  $\leq 21$  mmHg was  $0.48 \pm 0.16$ , and in those with IOP >21 mmHg was  $0.71 \pm 0.16$ . When we compared our distribution of VCDR with other studies in which used normal suprathreshold visual fields were used to derive the distribution of VCDR, we found a similar pattern.<sup>[24,25]</sup>

## CONCLUSIONS

The prevalence of POAG in this population was 1.62%. The prevalence was more in 50–60 years age group. The risk factors were raised IOP, hypertension, urbanization, and increasing age. The values of CCT, VCDR, and depth of anterior chamber, angle between iris and trabeculae and lens opacities help in the categorization of POAG and assessing the prognosis.

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# A Study to Compare Conjunctival Autografting with Sutures and Glue Free Sutureless Technique after Primary Pterygium Excision

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## Abstract

Pterygium is a fibrovascular proliferation of subconjunctival tissue, more commonly found in tropical and subtropical climatic condition. Conjunctival excision with bare sclera technique was used for years but high recurrence rate was the major point of concern. Amniotic membrane grafting and limbal conjunctival autografting are commonly used techniques these days and results are far more satisfactory in terms of recurrence. In our study we have done comparison between conjunctival autografting with sutures and glue free sutureless technique after primary pterygium excision. Study was performed in 80 eyes of 80 patients, 40 patients in each group. We observed that in sutureless glue free group, patients were significantly less symptomatic and postoperative complications were also less or at par with sutured conjunctival autografting. It is also a cost effective technique.

**Key words:** Conjunctival autograft, Glue free sutureless grafting, Amniotic membrane grafting, 10-0 nylon suture, Antimetabolite drugs

## INTRODUCTION

The word **pterygium** derived from Greek word *pterygion* means wings. It is a fleshy fibrovascular growth of conjunctiva arising from subconjunctival tissue with extension on cornea and this extension may vary from patient to patient. As far as aetiology is concerned apart from tropical environmental conditions and dry and dusty climate, deficiency of the stem cells is considered as one of the reason in various studies.<sup>(1)</sup> Diminished vision of the patient, irritation, foreign body sensation, photophobia and redness are the major complaints of the patients. Various techniques have been used but recurrence is the major point of concern. Technique of simple excision of pterygium with bare sclera was commonly used but it was associated with more recurrences so we looked for other methods. Conjunctival rotation with and without betaradiation, use of excimer laser or use of mitomycin C or 5 fluorouracil

after simple excision was associated with many drawbacks. In 1977 Thoft, first time described the use of conjunctiva for damaged ocular surface.<sup>(2)</sup> Amniotic membrane is another option for grafting but technique of using patient's own conjunctiva is found easier. Fixation of conjunctival autograft is done with the help of sutures or glue or by sutureless glue free technique where we use patient's own blood oozing on bare sclera. Sutureless grafting is also used successfully in gingival grafts and both the situations are comparable.<sup>(3)</sup>

With sutured grafting postoperative discomfort is more. Buttonhole, necrosis, inflammation, giant papillary conjunctivitis and granuloma formation is more commonly seen while with non sutured technique all these problems are less commonly seen. Fibrin glue is also used for dural leaks and in atrophic rhinitis.<sup>(4-6)</sup> With fibrin glue, fixation is easy and surgical time is also less but it is costly and in remote areas it's not easily available and chances of transmission of infection are more. Anaphylactic reactions have also been reported with fibrin glue.<sup>(7)</sup> In house preparation of autologous blood requires minimum of 24 hours and laboratory equipments and then there is variable proportion of thrombin and prothrombin<sup>(8,9,10)</sup> while with sutureless glue free conjunctival grafting, patient's own collected blood after excision is used. So it's inexpensive

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and chances of infection are also less. So sutureless glue free limbal conjunctival autografting is economical as well as having good results.

## MATERIAL AND METHODS

A prospective study was done comparing the results of conjunctival autografting with sutures and glue free sutureless conjunctival autografting. It was carried out in RKDF Medical college hospital & RC after taking consent of the patients and total 80 patients were selected from November 2014 to January 2016 and 1 year follow up was done. Preoperative vision, slitlamp examination, extraocular muscle movements, intraocular pressure and thorough fundus examination done prior to surgery.

### Inclusion Criteria

Patients of all age groups and both the sexes were included. All the patient had primary nasal pterygium. We included all cases of pterygium upto grade 2 pterygium with encroachment on cornea between pupillary margin and limbus.

### Exclusion Criteria

Recurrent pterygium cases, cases of trauma, glaucoma patients, diabetic patients, vascular disorders and patient who had retinal intervention were not included

Excision of primary pterygium on nasal side in 80 eyes of 80 patients was done followed by conjunctival autografting. Two groups were made.

Group A - Conjunctival autografting with 10-0 nylon suture (total 40 patients)

Group B - Conjunctival autografting with glue free sutureless technique (40 patients)

### Surgical Technique

Local peribulbar anaesthesia with 2% lignocaine and 0.5% bupivacaine given (3ml lignocaine + 1ml bupivacaine with hyaluronidase) given. Iris repositor is passed beneath the neck portion and head portion is lifted from the cornea with one toothed forcep. Only thick and fleshy portion was excised with the help of corneal scissors followed by corneal shelving by BP knife blade. Graft taken from superotemporal quadrant and it was kept 1mm larger in size. Graft was measured with calliper. Conjunctival scissors were used. No cautery was used. Graft cleaned thoroughly from sub conjunctival side to avoid tenon's tissue. Limbal to limbal orientation was maintained.

In Group A graft was kept on bare area and four interrupted 10-0 nylon sutures were applied at four corners.

In group B graft was kept pressed on bare area with even strokes for 10 minutes with IOL holding forcep

(Mc Pherson's forcep). Larger bleeds are not preferred as it displaces the graft. With little amount of oozing, graft is kept pressed for some time. Pressure from eyelids also helps.

Total surgical time was noted from starting of conjunctival dissection to final fixation of graft in both the groups. Patching was done with local antibiotics and steroid drops for 24 hours. In Group A sutures were removed after 2 weeks. Postoperative follow up was done on 2<sup>nd</sup> day, 1 week, 2 weeks, 4 weeks, 3 months, 6 months and 1 year.

### Parameters Studied

1. Duration of surgery
2. Symptoms of the patients
  - a. Waterying
  - b. Foreign body sensation
  - c. Redness
  - d. Photophobia
  - e. Pain
3. Graft odema
4. Giant papillary conjunctivitis
5. Graft related problems
  - a) Dehiscence
  - b) Retraction
  - c) Button hole
  - d) Sub conjunctival haemorrhage
  - e) wrinkling
6. Conjunctival granuloma
7. Infectious keratitis
8. Epithelial defect
9. Preoperative and postoperative vision
10. Recurrence

Post operatively patients satisfaction score was also evaluated on the basis of symptoms such waterying, photophobia, FB sensation, redness and irritation. It was graded as Grade 0 - dissatisfied, Grade 1 as moderate satisfaction, Grade 2 is highly satisfied. Recurrence was considered as fibrovascular proliferation encroaching the cornea more than 1.5 mm at the site of previous excision.

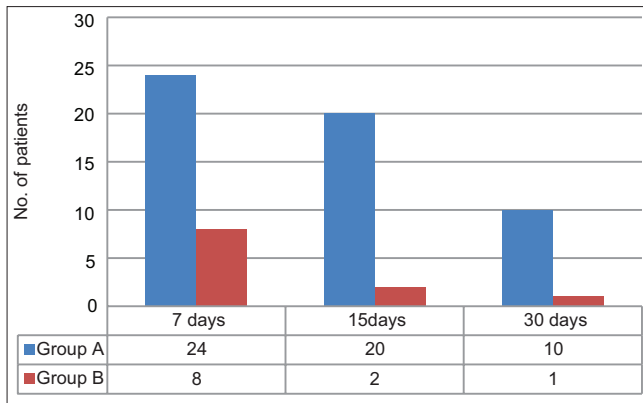
### Statistical Analysis

In present study comparative groups matching was done and all data were entered in excel sheet. Statistical analysis was done by using SPSS 16, test of significant applied whenever applicable. P value <.05 considered to be significant [Figures 1-3].

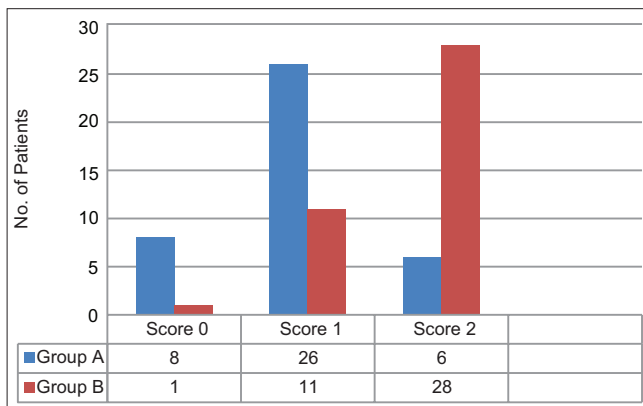
## RESULTS

This study was done in 80 eyes of 80 patients. Patients were divided into two groups. In Group A we included patients with limbal conjunctival autografting with sutures

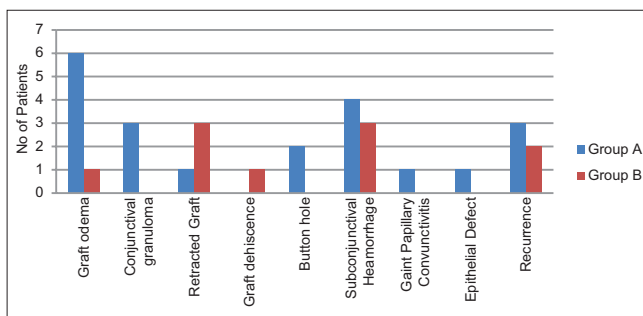
## Damle: Comparison of Conjunctival Autografting with Sutures and Glue-free Sutureless Technique after Primary Pterygium Excision



**Figure 1: Comparison of symptoms with duration**



**Figure 2: Satisfaction score at 1 month**



**Figure 3: Comparison of different post-operative complications**

and in Group B we included patients with glue free sutureless limbal conjunctival autografting. Demographic profile is given in Table 1. Follow up was done on 1<sup>st</sup> and 3<sup>rd</sup> postoperative day, 1<sup>st</sup> week, 2<sup>nd</sup> week, 4<sup>th</sup> week, 3 months, 6 months and at the end of 1 year. In all cases pterygium was on nasal side. Mean age was 43.12 years, In Group A 43.82 years and 43.6 years in Group B. This difference was not significant. Total intraoperative time was 22.025 minutes in Group A and 21.025 minutes B. Difference in operating time is not statistically significant between 2 groups. Probable explanation is in Group B though time required for suturing was saved but we had to wait for 10 minutes so that graft can get fixed properly.

Symptoms of pain, irritation, photophobia, foreign body sensation were reported by almost all the patient in both the groups on 1<sup>st</sup> postoperative day. At the end of 1 week, 2 weeks and 4 weeks patients were more symptomatic in Group A in comparison to Group B. Satisfaction score at the end of 4 weeks was also found higher in Group B which is statistically significant ( $P < .0001$ ). (Details shown in Table 2 and Bar charts).

Graft oedema was noticed in 6 patients in Group A and in 1 patient in Group B at the end of 1<sup>st</sup> week and gradually subsided with medical management only.

Conjunctival granuloma was noticed in 3 patients in Group A only and in 1 patient surgical intervention was required.

Retracted graft was seen in 1 patient in Group A and in 3 patients in Group B and no intervention was required. Difference between 2 groups is not statistically significant.

In 1 patient in Group B graft dehiscence was noticed on follow up on 3<sup>rd</sup> day and which was resutured. It was probably due to rubbing.

Button holing was found in 2 patients in Group A which may due to excessive traction on the graft due to sutures and none of the patient had buttonholing in Group B.

Sub conjunctival haemorrhage is noticed in 4 patients in Group A and 3 patients in Group B which is not statistically significant.

Giant papillary conjunctivitis was seen in 1 patient only in Group A.

Recurrence was seen in 3 patients in Group A and 2 patients in Group B at 3<sup>rd</sup> month follow up which is not statistically significant.

Epithelial defect was found in one patient in Group A and it was found healed at 4<sup>th</sup> week.

Difference in graft related problems between 2 groups is not stastically significant.

Complications like graft necrosis, wrinkling, symblepheron, infectious keratitis, extraocular muscle involvement and globe perforation were not seen.

## DISCUSSION

Various surgical techniques have been advocated for treatment of pterygium but recurrence of pterygium

**Table 1: Demographic profile**

	Number of patients	Group A (with sutures)	Group B (glue-free sutureless)
Age group			
25-35	26	14	12
36-45	23	11	12
46-55	18	08	10
56-65	08	05	03
66-75	05	02	03
Total No. of patients	80	40	40
Mean age	43.12	43.82	43.6
Sex			
Males	43	21	22
Females	37	19	18
Laterality			
RE	51	26	25
LE	29	14	15
Site of pterygium			
Nasal	80	40 (100%)	40 (100%)
Temporal	0	0	0

**Table 2: Comparison between two groups**

	Group A	Group B	P value
Average surgical time	22.025 min	21.125 min	
Postoperative assessment			
Postoperative symptoms			
At the end of 1 <sup>st</sup> week	24 patients (60%)	8 patients (20%)	P value 0.0577, t=2.6383 df=4 Standard error of difference=2.906 Chi-square 25.761, df-2, <b>P value 0.00000255</b>
At the end of 15 days	20 patients (50%)	2 patients (5%)	
At the end of 4 <sup>th</sup> weeks	10 patients (25%)	1 patients (2.5%)	
Patient satisfaction score at the end of 1 month	Score 0 – 8 patients (20%) Score 1 –26 patients (65%) Score 2-6 patients (15%)	Score 0-1 patient( 2.5%) Score 1-11 Patients (27.5%) Score 2-28 patients (70%)	
Graft related problems			P value equals 0.2378 t=1.2210 df=18 Standard error of difference=0.737
Graft oedema	06 patients	01 patient	
Conjunctival granuloma	3 patients	Nil	
Retracted graft	1 patient	3 patients	
Graft dehiscence	Nil	1 patient	
Button hole	2 patients	Nil	
Subconjunctival haemorrhage	4 patients	3 patients	
Giant papillary conjunctivitis	1 patient	Nil	
Infectious keratitis	Nil	Nil	
Epithelial defect	Nil	1 patient	
Recurrence	3 patients	2 patients	

has been a major point on concern. Pterygium excision with bare sclera has been used for years but it was associated with very high incidence of recurrence rate. Recurrence rates following bare sclera resection range from 24% to 89%.<sup>(11,12,13)</sup> Recurrences are commonly seen within 6 months.<sup>(14)</sup> Inflammation is caused by surgical trauma which leads to fibroblastic proliferation of subconjunctival tissue ultimately resulting in recurrence. Now resurgery of this recurrent pterygium is difficult as there is already some amount of corneal thinning

out of previous surgery and secondly due to scar tissue formation involving recti muscles and symblepheron formation.<sup>(15)</sup>

Other adjunctive therapies such as mitomycin C, 5 Fluorouracil, Beta irradiation or excimer laser are also used to reduce the recurrence rate. Reported recurrence rate following bare sclera resection with mitomycin application is between 0% and 38%<sup>(16,17,18)</sup> and is far less in comparison to bare sclera technique alone although it can lead to sight

threatening complications like scleral melting, ulceration or delayed epithelization.<sup>(19,20)</sup>

Amniotic membrane or direct suturing is also used to cover this bare sclera. Amniotic membrane is available commercially and also it is costly. Higher incidence of recurrence has also been reported with amniotic membrane grafting.<sup>(21)</sup>

Role of limbal stem cells in the aetiology of pterygium has been mentioned in various studies and apart from this it plays a barrier role against the overgrowth of conjunctiva over cornea and prevents the recurrence also. Reported recurrence rate following pterygium resection with conjunctival graft placement varies between 2% and 39%.<sup>(22-25)</sup> In our study also recurrence rate was 7.5 % in group A and 5 % in Group B. One of the way to fix conjunctival autografts or amniotic membrane to bare sclera is by using sutures. These sutures initiate a mild inflammatory reaction which can lead to pain, watering, foreign body sensation or photophobia in postoperative period and from view point of symptoms, patient's satisfaction score goes downside. These sutures also exert unequal tension on edges of the graft and can lead to button holing. Then removal of sutures after 2 weeks is another disadvantage against sutureless glue free technique or auto grafting with glue.

In our study also we found patient satisfaction score on higher side in Group B and difference in this score between 2 groups was statistically significant. Buttonholing was also noticed in Group A in 2 patients and it is suppose to be due traction at the edges of graft.

Autografting with sutures is comparatively more cost effective than autografting with glue though glue free sutureless autografting is most economical one.

Then time required in sutured autografting is more in comparison to conjunctival autografting with glue though at par with sutureless glue free conjunctival autografting as we keep the graft pressed for 10 minutes. In our study intraoperative time required in Group A was slightly more in comparison to Group B. The time difference was not much and not statistically significant. The probable explanation is that in Group A time was required for suturing while in Group B graft was pressed for 10 minutes.

Inflammatory reaction with sutures can lead to more recurrences and sometimes associated with granuloma formation. In our study we found conjunctival granuloma in 3 patients in Group A and it can be because of inflammatory reaction at suture site. In 1 patient giant papillary conjunctivitis was also seen in Group A.

Graft retraction and dehiscence was noticed in more number of cases in Group B though not statistically significant. Retraction was seen In 3 patients in Group B and in 1 patient in group A. This difference indicates better fixation with sutures. Although in all the patients with retraction no intervention was required but better cleaning of subtenon's tissue, avoiding large bleeds and giving sufficient time for the graft to get adhered can avoid postoperative retraction. Dehiscence in 1 patient was reported in Group B and there was a history of rubbing.<sup>(26)</sup>

Fibrin glue is a blood derived product and it has two components, one is fibrinogen component and another is thrombin component and used after mixing both the components. Advantages of glue over sutures is that time required is less but it's costly. Few studies reports formation of pyogenic granuloma with glue also and the probable reason is abnormal vascular endothelial growth and fibroblast activation.<sup>(27,28)</sup> Then apart from the cost, it is not easily available in remote areas and from view point of sterilisation one time use is recommended. Secondly inactivation procedures used during manufacturing do not cover viruses like hepatitis A and parovirus so there is always risk of transmission of these infections. Also these compounds can be deactivated by iodine preparation used at the time of surgery for cleaning purpose. In comparison to this, glue free sutureless autografting is most economical

## CONCLUSION

Sutureless glue free limbal conjunctival autografting is a very cost effective economical technique for pterygium surgery. Recurrence rate is also less and can be done in any setup as glue is not available everywhere. Complications related to sutures are also less.

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# A Clinical and Epidemiological Study of Pityriasis Versicolor

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## Abstract

**Background:** Pityriasis versicolor is a common, benign, chronic superficial skin infection caused by *Malassezia furfur* seen in all age groups. The data of prevalence and risk factors vary from place to place. An attempt is made to describe both clinical and epidemiological features in northern Kerala.

**Aim of the Study:** To study the clinical features, prevalence and demographic data of the patients with pityriasis versicolor in a tertiary teaching hospital.

**Materials and Methods:** A total of 187 patients attending the outpatient Department of Dermatology were included. Their demographic data, clinical features were collected and analyzed. The demographic details included age, sex, occupation, symptoms, duration, history of recurrence, animal contact, associated dandruff, family history, and use of shampoo and oiling the body.

**Observations and Results:** A total of 187 patients included in the study; 109 were males and the remaining 78 were females with a male to female ratio of 1.39:1. 20–40 years age group was most frequently affected with 42.24% patients. The overall mean age was  $31.65 \pm 5.25$ . Comorbid diseases were noted in 34/187 (18.18%) of the patients in this study. Among them, 12/34 were having diabetes mellitus (35.29%) and renal disorders in 08/34 (23.52%).

**Conclusions:** Pityriasis versicolor is a common skin disease seen in dermatology practice of any geographic area. The most common age group affected by pityriasis versicolor was 20–40 years. Male gender was commonly affected. There was no significant relationship between the prevalence and the age, gender, profession, personal hygiene, family history, and personal hygiene. Peak incidence of pityriasis versicolor was observed in April to July months. Chest was the most common site of presentation of lesions followed by abdomen and neck. Hypo-pigmented lesions were more common. Comorbid diseases were associated in 18.18% of the total patients.

**Key words:** Dermatophytosis, Fungal, *Malassezia furfur*, Pityriasis versicolor, Tinea versicolor, Yeast

## INTRODUCTION

Pityriasis versicolor is a mild, chronic superficial infection of the stratum corneum layer of the skin caused by *Malassezia furfur* and/or other species of *Malassezia*.<sup>[1]</sup> The genus *Malassezia* is part of the normal skin microflora, and it needs predisposing factors for multiplication and subsequent conversion from the commensal yeast form

to the mycelial phase (pseudo-filamentous parasitic form).<sup>[2]</sup> The lesions are characterized by discrete, serpentine, hyper or hypo-pigmented maculae developing on the skin; usually on the chest, upper back, arms, and abdomen. These lesions may enlarge and coalesce, but scaling, inflammation and irritation are minimal as the host response is minimal.<sup>[3,4]</sup> The organism *M. furfur* is lipophilic yeast/fungus which requires lipid in the medium for growth. The clinical diagnosis can be confirmed by direct microscopic examination of scraping of infected skin treated with 10% potassium hydroxide (KOH) or stained with lactophenol cotton blue stain. Short branched hyphae and spherical cells are observed.<sup>[5]</sup> Microscopic visualization of the fungi appears as short, thick hyphae with a large number of variously sized spores (spaghetti and meatball appearance).<sup>[6]</sup> This cutaneous infection has a worldwide

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distribution, especially in tropical areas. Infection by pityriasis versicolor usually infects adults due to increase sebum secretion after puberty.<sup>[7]</sup> A prevalence of 30–40% has been reported in tropical areas worldwide.<sup>[8]</sup> The risk factors described are warm season, profuse sweating, malnutrition, Cushing's disease, pregnancy, and the use of oral contraceptive pills.<sup>[9]</sup> The cosmetic effect of hypo-pigmented patches on the skin brings the patient to the dermatologist for a consultation.<sup>[10]</sup> When the infection affects the scalp known as pityriasis capitis presents as dandruff; pityrosporum folliculitis manifests as a follicular papulopustular eruption with pruritus.<sup>[11]</sup> Neonatal cephalic pustulosis is a non-follicular pustular eruption that occurs in 3% of the hospitalized neonates.<sup>[12]</sup> *M. furfur* is known to have a role in the pathogenesis of atopic eczema.<sup>[4]</sup> Tinea versicolor is increasing in incidence in view of the rise in immunosuppressive viral infections in the communities. A large-scale study is needed to understand the prevalence of this skin disease. This study is conducted in a tertiary teaching hospital to know the prevalence and clinical presentations in this part of Kerala.

#### Type of Study

The study was a prospective, descriptive, and cross-sectional study.

#### Period of Study

The study period was from April 2016 to September 2017.

#### Institute of Study

This study was conducted at Kannur Medical College Hospital, Anjarakandy, Kannur.

### MATERIALS AND METHODS

This study was conducted in a tertiary teaching hospital of northern Kerala between April 2016 and September 2017. 187 patients attending the Department of Dermatology with symptoms of superficial skin infections were included in the study. An Ethical Committee clearance was obtained, and an Ethical Committee approved consent form was used while conducting the study.

#### Inclusion Criteria

(1) Patients of all age groups were included. (2) Patients of all genders were included. (3) Patients with only superficial skin lesions were included. (4) Patients with a positive direct examination of tinea only were included.

#### Exclusion Criteria

(1) Patients with deep skin infections were excluded. (2) Patients with associated bacterial infections were excluded. (3) Patients with hypo-pigmented lesions other than tinea versicolor were excluded. A thorough clinical

history was taken in all the patients to include demographic details, duration of symptoms, and history of sweating and itching. The demographic details included age, sex, occupation, symptoms, duration, history of recurrence, animal contact, associated dandruff, family history, and use of shampoo and oiling the body. Following clinical examination, skin scraping was collected from all the patients who were diagnosed provisionally with pityriasis versicolor infection. Direct microscopic examination of specimens with 10% KOH and lactophenol cotton blue stain was done. All the data were analyzed using the standard statistical methods.

### OBSERVATIONS AND RESULTS

Among the 187 patients included in the study, 109 were males and the remaining 78 were females with a male to female ratio of 1.39:1. The number of patients between 0 and 20 years were 36 (19.25%), 20–40 were 79 (42.24%), 40–60 were 41 (21.92%), and above 60 years were 31 (16.57%). The mean age was  $31.65 \pm 5.25$ . In this study, students were 37 (19.78%), housewives were 28 (14.97%), laborers were 31 (16.57%), office goers were 23 (12.29%), agriculturists were 46 (24.59%), and shopkeepers were 22 (11.76%). 67 (35.82%) patients were with pityriasis versicolor complaints for 1–2 years, 59 (31.55%) were for 2–4 years, and 61 (31.62%) were for 4–6 years. The mean duration was  $4.30 \pm 1.20$  years. Among the 187 patients, 118 (63.10%) were newly registered cases, and the remaining 69 (36.89%) were recurrence cases. There was a history of family members having similar complaints in 64 (34.22%), and in 123 (65.77%) there was no family history. History of associated dandruff was observed in 49 (26.20%) and no dandruff in 128 patients (68.44%) and 75 (40.10%) patients were using shampoo in their daily head bath, and 112 (59.89%) were not using shampoo. 72 (38.50%) patients were using oil to apply to the body, 144 (77.00%) to the hair, and 125 (66.84%) were using both [Table 1].

The number of cases registered in the months of April and May was 52; 39 in the months of June and July, 23 in August and September, 11 in October and November, 24 in December and January, and 38 in February and March [Table 2].

In this study among the patients, lesions were observed on the chest in 56 (29.94%), back in 29 (15.50%), on the neck in (19.78%), in axillae in (13.90%), on the face in 13 (06.95%), on the abdomen in (24.59%), and on limbs in 20 (10.69%) patients [Table 3].

Hypo-pigmented lesions were noted in 83 (44.38%) of the patients in the study. Hyper-pigmented lesion in

**Table 1: Demographic data in the study group (n=187)**

Observation	Number (%)
Age	
0–20	36 (19.25)
20–40	79 (42.24)
40–60	41 (21.92)
>60	31 (16.57)
Gender	
Male	107 (57.21)
Female	080 (42.78)
Occupation	
Students	37 (19.78)
Housewives	28 (14.97)
Laborers	31 (16.57)
Office goers	23 (12.29)
Agriculturists	46 (24.59)
Shopkeepers	22 (11.76)
Duration (Years)	
1–2	67 (35.82)
2–4	59 (31.55)
4–6	61 (32.62)
Recurrence	
Yes	069 (36.89)
New case	118 (63.10)
Family history	
Yes	064 (34.22)
No	123 (65.77)
Dandruff	
Yes	049 (26.20)
No	128 (68.44)
Using shampoo	
Yes	075 (40.10)
No	112 (59.89)
Application of oil	
Body	072 (38.50)
Hair	144 (77.00)
Both	125 (66.84)

**Table 2: The incidence in different months of the year (n=187)**

Seasonal months	Number (%)
April–May	52 (27.80)
June–July	39 (20.85)
August–September	23 (12.29)
October–November	11 (05.88)
December–January	24 (12.83)
February–March	38 (20.30)

59 (31.55%) and mixed type were seen in 45 (24.06%) patients [Table 4].

Comorbid diseases were noted in 34/187 (18.18%) of the patients in this study. Among them, 12/34 were having diabetes mellitus (35.29%), renal disorders in 08/34 (23.52%), patients using steroids for various systemic illnesses were 07 (20.58%), patients with malignancies were 3 (08.82%) and with immunosuppressive diseases were 4 (11.76%), [Table 5].

**Table 3: The incidence of lesions in different parts of the body (n=187)**

Site of lesions	Number (%)
Chest	56 (29.94)
Back	29 (15.50)
Neck	37 (19.78)
Axillae	26 (13.90)
Face	13 (06.95)
Abdomen	46 (24.59)
Limbs	20 (10.69)

**Table 4: The pigmented nature of lesions in the study (n=187)**

Type of lesion	Number (%)
Hypo-pigmented	83 (44.38)
Hyper-pigmented	59 (31.55)
Mixed	45 (24.06)

**Table 5: The comorbid conditions in the study group (n=34)**

Comorbid diseases	Number (%)
Diabetes mellitus	12 (35.29)
Renal disorders	08 (23.52)
Using Steroids	07 (20.58)
Malignancies	03 (08.82)
Immunosuppressive diseases	04 (11.76)

## DISCUSSION

The present study was a hospital based prospective study drawing patients from all walks of life and professions including students. The laborers and agriculturists were from neighboring villages. 20–40 years age group was most frequently affected with 42.24% patients. The overall mean age observed was  $31.65 \pm 5.25$ . This was followed by 40–60 years age group. Kaur *et al.*<sup>[13]</sup> in their study also observed similar findings with mean age of  $30.25 \pm 1.85$ ; unlike Krishnan and Thapa<sup>[14]</sup> who found 15–29 years being the most common age group suggesting that the peak of infection coincides with the sebum production and hormonal influence. The mean duration of the disease in this study was  $4.30 \pm 1.20$  years. Banerjee<sup>[15]</sup> had reported that duration of disease in 28.75% of the patients was between 1 and 20 years. In this study, male patients were more affected than female patients. This is similar to the observation made by Ghosh *et al.*,<sup>[17]</sup> Krishnan and Thapa,<sup>[14]</sup> and Rao *et al.*,<sup>[16]</sup> which was explained as due to major involvement of males in outdoor activities with maximum exposure to high temperature and humidity. However, Kaur *et al.*<sup>[13]</sup> observed in their study equal predilection in both genders to pityriasis versicolor. While Nikpoor and Leppard<sup>[18]</sup> indicated the incidence of this infection was



higher in women. The present study the hypo-pigmented lesions 83 (48.34%) were more common than hyper-pigmented lesions 59 (31.55%); mixed lesions were observed in 45 (24.06%) patients. Similar findings were observed by Shah *et al.*<sup>[19]</sup> wherein hypo-pigmented were seen in 84.17%, hyper-pigmented in 8.63%, and mixed in 07.19%. Krishnan and Thapa<sup>[14]</sup> observed hypo-pigmented in 84%, hyper-pigmented in 9%, and mixed in 6% of their patients. Kabbin *et al.*<sup>[20]</sup> observed hypo-pigmented in 67%, hyper-pigmented in 31%, and mixed in 2% of their patients. Rao *et al.*<sup>[16]</sup> observed mixed variety in 16.60%, hyper-pigmented in 08.30%. This variation of morphological appearance could be explained by the differences in climatic conditions and different study population skin color of the native populations. In this study, chest wall was the most common site of presentation of the lesions with 56 (29.94%), followed by abdomen 46 (24.59%) and then the neck 37(19.78%). Krishnan and Thapa<sup>[14]</sup> Rao *et al.*<sup>[16]</sup> and Kabbin *et al.*<sup>[20]</sup> found in their patients the lesions being common on trunk, neck, and back. The distribution of lesions depends on the distribution and abundance of sebaceous glands in that particular region. Family history was seen in 34.22% of the patients in this study whereas Ghosh *et al.*<sup>[16]</sup> and Rao *et al.*<sup>[16]</sup> observed in 25% of their patients. Table 1 summarize the different occupations and social status of the patients of this study, and it was observed that there was no correlation between their occupations and the prevalence of appearance of the lesions of pityriasis versicolor. Similarly, there was no correlation between the disease and the personal hygiene. It has been documented that military personnel, athletes, and those doing hard works that usually associated with hyper sweating were more vulnerable to pityriasis versicolor infection.<sup>[21]</sup> More than 72% of the patients came to the department to seek remedy for the cosmetic reason rather than itching or inflammation in this study. More than 48% of the patients registered in the months of April to July in this study Table 2 correlating with the hot, humid nature of weather during these months in this part of Kerala. Rao *et al.*<sup>[16]</sup> and Ghosh *et al.*<sup>[16]</sup> showed prevalence in the months of August to September in their studies. Recurrence rate in this study observed was 36.89% which resembles the studies of Ghosh *et al.*<sup>[16]</sup> with 48.18%; but Rao *et al.*<sup>[16]</sup> observed only in 1.60%, which may be attributed to the idiosyncratic nature of the condition, the local factors such as humidity, high temperature that remain unchanged and which help in contributing to varying recurrence rates of yeast even after treatment. Comorbid conditions in this study were noted in 34/187 (18.18%) of the patients. Among them, 12/34 were having diabetes mellitus (35.29%), renal disorders in 08/34 (23.52%), patients using steroids for various systemic illnesses were 7 (20.58%), patients with malignancies were 3 (08.82%), and with immunosuppressive diseases were 4 (11.76%). Ghosh *et al.* have reported coexisting systemic

diseases such as diabetes mellitus, lymphoproliferative malignancies, and use of immunosuppressive and systemic steroids in 2.73%, 1%, and 2.73%, respectively. KOH was positive in 80% of cases in our study as like other studies by Kindo *et al.*<sup>[22]</sup> Chaudary *et al.*<sup>[23]</sup> while Rao *et al.*<sup>[16]</sup> have reported relatively higher rates as 46.60%.

## CONCLUSIONS

Pityriasis versicolor is a common skin disease seen in dermatology practice of any geographic area. The most common age group affected by pityriasis versicolor was 20–40 years. Male gender was commonly affected. There was no significant relationship between the prevalence and the age, gender, profession, personal hygiene, family history, and personal hygiene. Peak incidence of pityriasis versicolor was observed in April to July months. Chest was the most common site of presentation of lesions followed by abdomen and neck. Hypo-pigmented lesions were more common. Comorbid diseases were associated in 18.18% of the total patients.

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# Correlative Studies between Computed Tomography and Magnetic Resonance Imaging Scan Findings and Histopathology of Solitary Fibrous Tumors of Abdomen and Pelvis

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## Abstract

**Background:** Solitary fibrous tumors (SFTs) are a unique group of mesenchymal neoplasms of fibroblastic or myofibroblastic origin. These tumors were originally described as "benign fibrous mesothelioma" of the pleural cavity, but presently they are being reported from all organs in the body. They are reported from abdominal organs and need to be differentiated from other solid tumors such as leiomyosarcomas, neurogenic tumors, pheochromocytomas, lymphoma, desmoid tumors, malignant fibrous histiocytomas, mesothelioma, and fibromas.

**Aim of the Study:** The aim of the study was to study the radiological features of SFTs of abdomen and pelvis on computed tomography (CT) scan and magnetic resonance imaging (MRI) and to correlate with their pathological features retrospectively.

**Materials and Methods:** A total of 24 patients with SFTs attending the tertiary teaching hospital were included in the study. Demographic data were collected from the case sheets for analysis. Radiological signs of CT and MRI scans from the patients were observed and correlated retrospectively with the histopathological study of excised surgical specimens to understand and standardize the characteristic features.

**Observations and Results:** Among the 28 patients there were 18 (75%) male patients and 6 (25%) female patients. The male to female ratio was 1:3. The mean age was  $42.65 \pm 2.70$  years. The presenting symptoms were lump in the abdomen, pain, mass in the abdominal wall, urinary obstruction, constipation and sometimes neurologic or vascular symptoms. CT and MRI scans showed round or oval, homogenous or heterogeneous and markedly enhanced lesions without secondaries. Histopathological examination showed both cellular and fibrous variants of the SFTs.

**Conclusions:** The radiological signs of solid fibrous tissue tumors are well-defined, hypervascular masses with variable degrees of necrosis, cystic change, or hemorrhage. On MRI they manifested as heterogeneous hyperintensities on T2WI. The specimens following surgical excision retrospectively correlate well with the radiological findings in terms of vascularity and tissues content.

**Key words:** Computed tomography scan, Magnetic resonance imaging scan Tumors, Pleura, Peritoneum, Solitary fibrous tissue tumors

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## INTRODUCTION

Solitary fibrous tumors (SFTs) are rare mesenchymal Tumors and account for <2% of all soft tissue tumors.<sup>[1]</sup> They were described as a distinct pathological entity in 1931 by Klemperer and Rabin. Earlier they were thought to be occurring only in pleura, pericardium, and peritoneum

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and were thought to be of mesothelial or submesothelial origin. Recent advances in pathology have changed the concept of these tumors, their distribution and remarkable histologic heterogeneity.<sup>[2]</sup> Now SFTs are considered as pathologically diverse, ubiquitous neoplasms of fibroblastic or myofibroblastic origin. Hemangiopericytoma and SFT form a histologic spectrum of fibroblastic type mesenchymal neoplasms with overlapping clinical, imaging, and cytopathologic features.<sup>[3]</sup> The new WHO classification considers most of the hemangiopericytomas as SFTs.<sup>[2,4]</sup> Now they are recognized as more common in extrapleural sites than in the pleura.<sup>[5-7]</sup> They are typically large, slow-growing soft tissue neoplasms. They can be benign or malignant.<sup>[8,9]</sup> They are asymptomatic, and symptoms are mainly due to their compression in the neighboring viscera or parenchyma. Computed tomography (CT) scans play a major role in their detection, characterization, and localization and guide the surgeons. Extrapleural SFTs have a favorable outcome after surgical resection. Even today the most extensive reports regarding the imaging characteristics of SFTs in the abdomen and pelvis are reported by Shanbhogue *et al.*,<sup>[10]</sup> Zhang *et al.*<sup>[11]</sup> and Ginat *et al.*<sup>[12]</sup> and others focused on case reports.<sup>[13,14]</sup> In this study an attempt is made to correlate the CT scan and magnetic resonance imaging (MRI) radiological findings with the histopathological findings of SFTs.

### Type of Study

This was a retrospective study.

### Period of Study

The study period was from April 2015 to March 2017.

### Institute of Study

This study was conducted at Kannur Medical College, Anjarakandy, Kannur, Kerala.

## MATERIALS AND METHODS

Based on medical records of 24 patients treated for soft fibrous tumors in the department of surgery of a tertiary teaching hospital a retrospective study was conducted. All the data were collected from the medical records section. An Ethical Committee Clearance was obtained for the study. Inclusion criteria: (1) All the patients irrespective their age were included. (2) Patients with soft fibrous tissue tumors confirmed by Histopathological examination (HPE) were included. (3) Patients with SFTs involving the abdomen and pelvis are included. Excluding criteria: (1) Patients treated for SFT tumors involving the pleura were excluded. (2) Patients not confirmed on HPE to have SFTs were excluded. Demographic data of the patients were collected from the case sheets for analysis. All the patients had undergone CT scan and wherever necessary

an MRI scan was done. CT scan was done using a 16 multi-detector CT (light speed VCT, GE Healthcare). MRI scans were performed with a 1.5 T scanner (GE). The images were reviewed by a single radiologist of 12 years' experience. The CT and MRI were evaluated for location, size, shape, margin, internal architecture, CT density, and MRI signal intensity compared with adjacent muscle, pattern of enhancement, and changes in adjacent structures. The radiological features of all the cases were noted. The degree of mass enhancement was assessed subjectively and categorized as follows: Mild, when the enhancement was similar to that of adjacent muscle; moderate, when the enhancement was higher than that of muscle but lowers than that of blood vessels; marked, when the enhancement was approaching that of blood vessels. These imaging findings were correlated with the microscopic findings of the surgically obtained specimens and compared between the histologically benign and malignant groups. Ultrasound-guided needle biopsy was attempted in 11 patients, and the analysis of the reports was done. 23 out of the 24 patients underwent surgery for excision of the tumors. The morphological features and hematoxylin and eosin staining were used to study the cellular pattern of the tumors. Retrospective correlation between radiological features and final HPE reports was done. All the data were analyzed using standard statistical methods.

## OBSERVATIONS AND RESULTS

A total of 28 patients presenting with features of abdominal and pelvis tumors were included in this study. Among the 28 patients, there were 18 (75%) male patients and 6 (25%) female patients. The male to female ratio was 1:3. The youngest patient was aged 19 years, and the elderly patient was aged 68 years with a mean age was  $42.65 \pm 2.70$  years. The presenting symptoms were lump in the abdomen, pain, mass in the abdominal wall, urinary obstruction, constipation and sometimes neurologic or vascular symptoms. 3 patients had symptoms of hypoglycemia, and all the tumors in this group were originating in the pelvis [Table 1].

**Table 1: The incidence of different symptoms in the study group (n-28)**

Observation	n (%)
Lump in the abdomen	14 (58.33)
Mass in the abdominal wall	03 (12.5)
Pain	12 (50)
Urinary obstruction	04 (16.66)
Constipation	06 (25)
Radiating backache pain	05 (20.83)
Erectile dysfunction	01 (4.16)
Hypoglycemia	03 (12.5)



Among the 24 patients, the origin of the tumor was from different sites involving various organs in the abdomen and pelvis. The tumors presenting in the abdomen were 15 (62.50%) and from the pelvis were 9 (37.50%) distribution of these tumors is shown in Table 2.

Among the 23 operative specimens sent for histopathological reporting, the gross appearance of the tumors showed the size varying from 4.6 to 19.8 cm (mean, 09.35 cm). 15 tumors were round, and 6 were oval, and 3 were lobulated. 17 of the tumors had displaced adjacent organs. They were found capsulated, firm and well circumscribed in 21/23 (91.30%). The cut surface showed a whorled appearance with yellow tan and areas of necrosis and hemorrhage were observed in all the specimens. Microscopic appearance showed typically juxtaposition of either hyper- and hypo-cellular spindle cells proliferation with dense collagenous stroma, and numerous thin-walled blood vessels with a “staghorn configuration” (histologic hallmark) of hemangiopericytoma or SFT [Figure 1].

The fibrous type of HPE reports was observed in 16/24 (66.66%) patients, cellular type in 6 (25%) and

2/24 (08.33%) patients it was mixed type with vascular component [Table 3].

Retrospectively the CT scan and MRI scan pictures were analyzed in this study of patients with tumors of abdomen and pelvis, and out of 24 patients, 11 underwent both the types of imaging studies with contrast. 13 patients had only CT scan pictures. The radiological features of the 24 patients are tabulated in Tables 4 and 5. No lymphadenopathy or distant metastases were detected on the CT and MR images at initial evaluation.

Unenhanced MRI in a patient aged 45 years revealed an SFT arising from the seminal vesicle; a T1-weighted and gadolinium-enhanced T1-weighted homogenous isodense mass lesion is shown in Figure 2.

A contrast-enhanced CT scan, obtained in the arterial phase, shows a well-defined hypervascular mass with intense enhancement (arrow) in the pancreatic tail [Figure 3].

AN MRI showing a SFT arising from the kidney in a 39-year-old woman; axial fat-suppressed T2-weighted image [Figure 4].

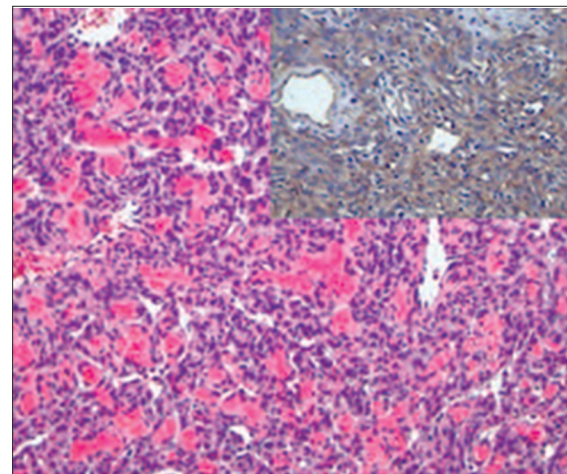
**Table 2: The sites of origin of the tumour**

Site of origin	n (%)
Abdominal wall	03 (12.5)
Liver	04 (16.66)
Kidney	02 (08.33)
Pancreas	02 (08.33)
Peritoneum	04 (16.66)
Sigmoid colon	03 (12.5)
Prostate	01 (04.16)
Seminal vesicle	01 (04.16)
Urinary bladder	02 (08.33)
Uterine adnexa	02 (08.33)

**Table 3: The HPE findings in the study (n=24)**

HPE findings	n (%)
Fibrous variant	16 (66.66)
Cellular variant	06 (25)
Mixed variant with high vascular component	02 (08.33)

HPE: Histopathological examination



**Figure 1: The histopathological examination (Hematoxylin and eosin stain) of the specimen of solitary fibrous tumors**

**Table 4: Radiological findings of patients with both CT scans and MRI scans with enhancement undertaken (n=11)**

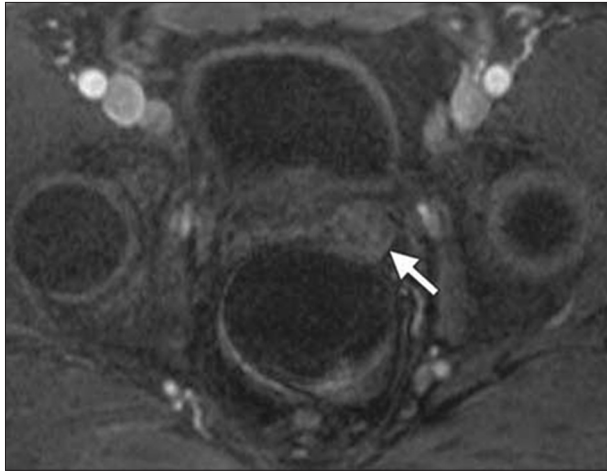
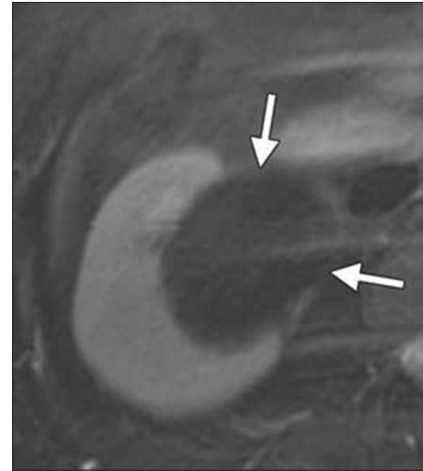
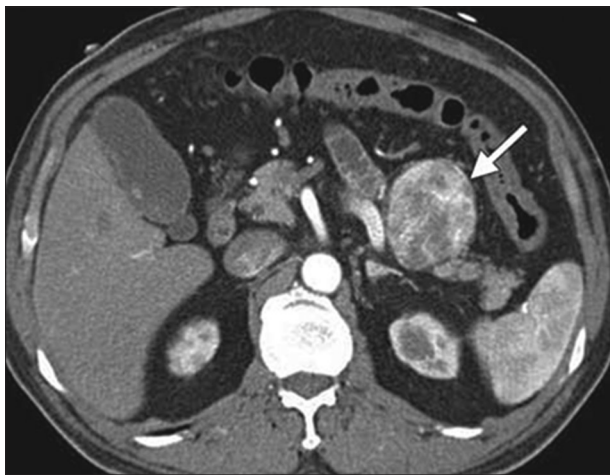
Tumor site	Size (cm <sup>2</sup> )	Shape margin	CT density- MRI intensity	Degree and pattern of enhancement
Liver- 04	04	Round, well defined	Homogeneous hyperintensity (T2WI)	Marked homogenous
Kidney- 02	02	Round, well defined	Homogeneous isodensity	Marked homogenous
Pancreas- 02	02	Round, well defined	Homogeneous isodensity	Marked homogenous
Prostate	01	Oval, well defined	Homogeneous hyperintensity (T2WI)	Marked homogenous
Uterine adnexa	02	Oval, well defined	Homogeneous hyperintensity (T2WI)	Marked heterogeneous

CT: Computed tomography, MRI: Magnetic resonance imaging

**Table 5: Radiological findings of exclusively CT scans of patients with SFTs (n-13)**

Tumor site	Size (cm <sup>2</sup> )	Shape margin	CT density- MRI Intensity	Degree and pattern of enhancement
Abdominal wall	03	Round, well defined	Isodensity with patchy necrosis	Marked homogenous
Peritoneum	04	Oval, well defined	Isodensity with patchy necrosis	Marked heterogeneous
Sigmoid colon	03	Round, well defined	Isodensity with patchy necrosis	Marked heterogeneous
Seminal vesicle	01	Oval, well defined	Homogeneous isodensity	Marked homogenous
Urinary bladder	02	Round, well defined	Homogeneous isodensity	Marked heterogeneous

CT: Computed tomography, MRI: Magnetic resonance imaging, SFT: Solitary fibrous tumors

**Figure 2: A magnetic resonance imaging finding of solitary fibrous tumors in seminal vesicle****Figure 4: A magnetic resonance imaging scan image of solitary fibrous tumors arising from the kidney****Figure 3: A solitary fibrous tumors arising from the tail of the pancreas showing marked enhancement on computed tomography scan**

## DISCUSSION

Solitary fibrous tissues tumors are rare, spindle cell mesenchymal origin, with an age of onset around 50–60 years and equal distribution in men and women. In the present study, the youngest patient was aged 19 years, and the elderly patient was aged 68 years with a mean age was  $42.65 \pm 2.70$  years. Patients in a series study by Li *et al.*<sup>[14]</sup> the incidence ranged from 1 to 76 years, but the incidence was higher in men than in women with a sex ratio of 4:1.

In the present study, the male to female ratio was 1:3. Although SFTs were thought to occur most frequently in the pleura initially, now they are being reported virtually from anywhere or throughout the body, while involvement of the abdomen and pelvis is particularly rare.<sup>[4]</sup> SFTs in the abdomen and pelvis are a diagnostic challenge to both clinicians and radiologists despite its characteristic histological and immuno histochemical features. Extra pleural SFTs were typically demonstrated as large, slow-growing soft tissue tumors.<sup>[10]</sup> Symptoms related to the sites of occurrence of tumors and adjacent organs involved are frequent. They usually present as a palpable mass, pain, gross hematuria, bowel obstruction, and urinary retention, or obstruction,<sup>[2,15]</sup> systemic hypoglycemia is reported in SFTs of pelvic origin in the literature and also reported in the present study.<sup>[4,13]</sup> All the symptoms usually disappear after removal surgically. Hemangiopericytomas earlier described as a different entity of tumors are now described as a cellular variant of SFT tumors.<sup>[2,3]</sup> SFTs are usually well demarcated; well capsulated benign tumors and majority of them are highly vascular and have a tendency for hemorrhages, myxoid degeneration, and necrosis.<sup>[2]</sup> On HPE these tumors show a spectrum of cellularity and vascularity at one end to predominantly fibrous lesions containing fibrous areas and hyalinized thick-walled vessels.<sup>[2,3,14]</sup> Immuno-histochemical studies of these sections show variable expression of CD34, CD99,

and bcl-2 antigens; and the fibrous form demonstrates strong reactivity with CD34, whereas the cellular form demonstrates weak reactivity.<sup>[2]</sup> Malignant transformation is noted in SFTs and the histological features that may help to identify them; which includes large size, infiltrative margins, hypercellularity, nuclear atypia, and mitotic activity ( $\geq 4/10$  high-power fields), and the presence of necrosis and hemorrhage.<sup>[2,14]</sup> After malignant transformation, these SFTs shed their CD34 immuno reactivity and over express Ki-67, P53, and S-100.<sup>[16]</sup> In the present study, there was no malignant transformation observed. Recurrence is common following surgical excision of the SFTs, and the cause and risk factor for recurrence are invaded margins of the tumor.<sup>[7]</sup> Radiological findings provide useful information, such as detection, characterization, and localization of tumors. In addition, it can depict the local extent, possible invasion into adjacent structures, and loco regional, and distant metastases. The most common imaging finding reported in this study was large, well-defined, round, oval, or lobulated hyper vascular tumor masses that tended to displace or invade adjacent structures such as the bowel, urinary bladder, seminal vesicle, and vessels. These findings are similar to studies by other authors.<sup>[4,5,12]</sup> The common plain CT scan findings were an isodense mass with patchy hypodensity in the present study. The reason for attenuation was that it depended on the collagen content, as hyperdense lesions have abundant collagen.<sup>[6]</sup> Calcification is rare.<sup>[4,6]</sup> In the present study, MRI scan showed isointense or slightly hyper intense on T1WI and heterogeneously hyper intense on T2WI images. The images of heterogeneous signal intensity were probably due to components of hemorrhage, necrosis, cystic, or myxoid degeneration, and Hyalinized stromal contents.<sup>[4,7]</sup> The tumors mimicking the SFTs on CT scan or MRI imaging are leiomyosarcomas, neurogenic tumors, pheochromocytomas, lymphoma, desmoid tumors, malignant fibrous histiocytomas, mesothelioma, and fibromas with predominant fibrous content and varying.

## CONCLUSIONS

The radiological signs of solitary fibrous tissue tumors are well-defined, hypervascular masses with variable degrees

of necrosis, cystic change, or hemorrhage. On MRI they manifested as heterogeneous hyperintensities on T2WI. The specimens following surgical excision retrospectively correlate well with the radiological findings in terms of vascularity and tissues content.

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# Closed Proximal Phalangeal Fracture Management in Hand: An Outcome Analysis

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## Abstract

**Introduction:** The proximal phalanx (PP) of the fingers is fractured more frequently than the middle or even distal phalanges. The problems of malunion, stiffness, and sometimes loss of skin or other soft tissue associated with PP fracture increases the disability.

**Aim:** The objective of the study was to analyze the treatment outcome in a series of closed proximal phalangeal fractures of the hand.

**Materials and Methods:** All acute and delayed presentation of closed proximal phalangeal fracture patients was included in the study. The treatment modalities were conservative treatment and surgical treatment.

**Results:** Most commonly performed procedure was open reduction and internal fixation (ORIF) (58%). Postoperatively, total range of movements achieved up to 270° in 83% of patients treated with ORIF. Grip strength is achieved up to ≥90% of normal strength in 90% of patients treated with ORIF, 83% of patients in patients treated with post-operative pain (POP), 67% of patients treated with an external fixator. Pinch strength achieved up to ≥90% of normal strength in 97% of patients treated with ORIF, 92% of patients treated with POP, and 89% of patients treated with an external fixator.

**Conclusion:** External fixator for hand injuries is a cheap, technically less demanding and effective procedure. This procedure is mainly used in comminuted and intra-articular fractures.

**Key words:** Closed reduction, Hand, Open reduction, Proximal phalanx fracture

## INTRODUCTION

Fractures of metacarpals and phalanges are the most common fractures of the upper extremity and account for 10% of total such cases. The outer rays of the hand are most commonly injured.<sup>[1]</sup> Unfortunately, the metacarpal and phalangeal fractures are often neglected or regarded as trivial injuries.<sup>[2]</sup> The proximal phalanx (PP) of the fingers is fractured more frequently than the middle or even distal phalanges. The deformity with considerable displacement is typical when the PP is fractured, fractures commonly

involving the outer rays. The PP of the fingers is fractured more frequently than other phalanges.<sup>[3]</sup> The deformity with displacement is typical when the PP is fractured. Majority of the fractures are stable and can be treated with non-operative methods. They are fare well with protective splintage and early mobilization. However, closed treatment has poor outcome due to malunion, stiffness, and associated soft tissue injury.<sup>[4]</sup> Proximal phalangeal fractures with angulations >20° in anteroposterior view and >15° in lateral view, <50% bony contact, rotational deformity, collapse, and multiple fractures require operative fixation. Operative fixation must be used judiciously. Selection of the treatment depends on fracture location, fracture geometry, deformity, whether they are open or closed and fracture stability. Final outcome is assessed by pain-free union, deformity, total active motion, grip strength, pinch strength and metacarpophalangeal joints (MCP), proximal interphalangeal, and distal interphalangeal joint motion. In

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case of thumb outcome is assessed by palmar abduction and total flexion.<sup>[5,6]</sup>

### Aim

The objective of the study was to analyze the treatment outcome in a series of closed proximal phalangeal fractures of the hand.

## MATERIALS AND METHODS

This is a non-randomized descriptive prospective study was conducted in Coimbatore Medical College Hospital. Inclusion criteria: All acute and delayed presentation of closed proximal phalangeal fracture patients were included. Exclusion criteria: Patients with open proximal phalangeal fractures and who cannot make assessment of their management outcome were excluded. Patients with a fracture involving multiple fingers are excluded. On first consultation name, age, and sex recorded in the patients with proximal phalangeal fractures. History of mode of injury, duration, pain, and previous treatment received were recorded. To diagnose proximal phalangeal fractures effectively, the mechanism of injury and the force of the trauma should be queried in the initial examination. After careful inspection, identification of the most painful area should be done by palpation. The active and passive ranges of motion of the joints, existence of a possible capsule and ligament instability should be searched. The stability of the joint can be assessed with the stress test, which is performed while the finger is in flexion and extension. In X-ray examination, three views are essential: Anteroposterior, lateral and 45° oblique. Articular fractures are often not seen without the oblique views. Anatomically, proximal phalangeal fractures can be divided into four categories, fracture involving condyle, neck, shaft, and base.

## RESULTS

Out of 50 patients studied, males were commonly affected (88%). The most common age group involved in between the age of 26 and 35 years.

Road traffic accidents being the predominant cause. Right hand is more commonly involved (54%). Out of five fingers, F5 is more commonly involved (36%).

Among fracture sites, shaft is more commonly involved (48%). Oblique and spiral type of fractures is commonly encountered (56%) and most of the fractures are unstable (76%) [Figures 1 and 2].

About 86% of patients are presented with joint involvement, and about 78% of patients are intervened within 2<sup>nd</sup> day of fracture [Figure 3].

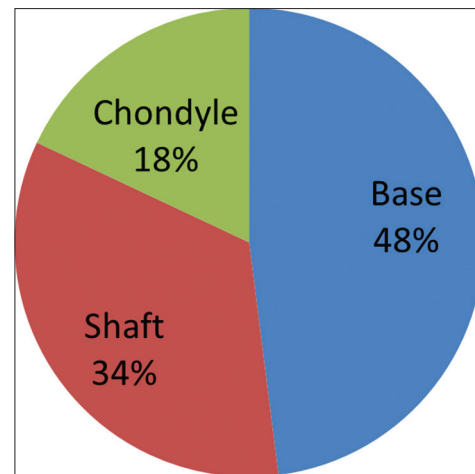


Figure 1: Distribution of fracture site

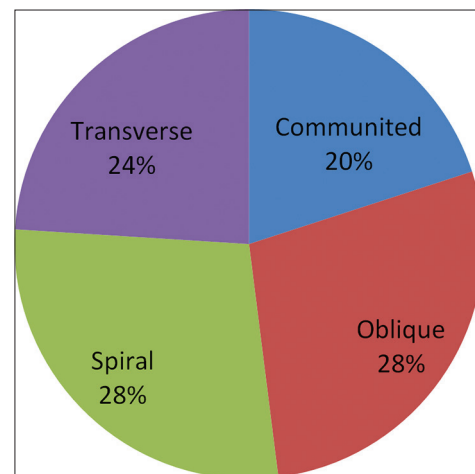


Figure 2: Distribution of type of fracture

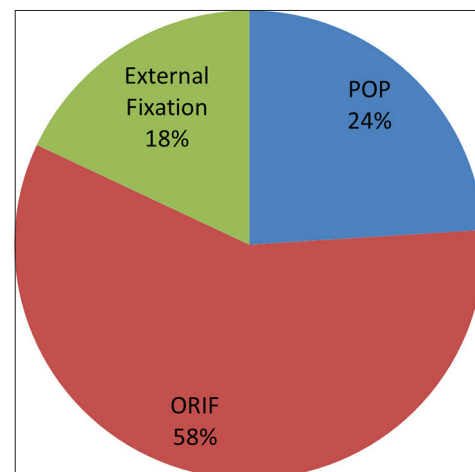


Figure 3: Distribution of type of intervention

Most commonly performed procedure was open reduction and internal fixation (ORIF) (58%). Patients managed with post-operative pain (POP) in 24% of patients and external fixator in 18% of patients [Table 1].



**Figure 4: Open reduction and k wire fixation for proximal phalanx fractures**

Postoperatively, total range of movements achieved up to 270° in 83% of patients treated with ORIF, 75% of patients treated with POP, and 44% of patients treated with external fixator.

Grip strength is achieved up to  $\geq 90\%$  of normal strength in 90% of patients treated with ORIF, 83% of patients in patients treated with POP, and 67% of patients treated with external fixator.

Pinch strength achieved up to  $\geq 90\%$  of normal strength in 97% of patients treated with ORIF, 92% of patients treated with POP, and 89% of patients treated with external fixator.

About 94% of patients managed with ORIF, returned to their work within 13 weeks, 89% of patients managed with external fixator returned to their work in 13 weeks, and 75% of patients managed with POP returned to their work in 13 weeks [Figure 6].

Pin tract infection encountered in 4% of patients, pin loosening presented in 6% of patients and malunion in 2% of patients.



**Figure 5: External fixator for proximal phalanx fractures**

Based on the above results it was concluded that the average outcome was good in ORIF group and moderate in POP group.

The assessment of outcome helps in forming a protocol for the management of proximal phalangeal fractures and pinpoints the deficiencies existing in the management and the need to improve the already evolving management techniques.

**Table 1: Distribution of outcome**

Procedure	Total cases	TROM	Grip strength	Pinch strength	Return to work in 13 weeks (%)
		≥270° (%)	≥90 (%)	≥90 (%)	
POP	12	9 (75)	10 (83)	11 (92)	75
ORIF	29	24 (83)	26 (90)	28 (97)	94
External fixation	9	4 (44)	6 (67)	8 (89)	89

TROM: Total range of movements, POP: Post-operative pain, ORIF: Open reduction and internal fixation



**Figure 6: Conservative management of proximal phalanx fractures**

Thus this study shows the importance of analysis of the outcome of proximal phalangeal fracture management thereby critically evaluating and helping us to adopt methods of management of proximal phalangeal fractures which is still evolving to improve and prognosticate our results.

## DISCUSSION

Extra-articular fractures of the distal phalanx are common and are associated with significant soft tissue injury. Most distal phalangeal fractures are crush injuries from a perpendicular force. They can be associated with significant debility, usually in the form of soft tissue loss, nail bed injury, or post-traumatic neuromas. Intra-articular fractures of the distal phalanx can result from avulsion of either the extensor tendon, also known as mallet fractures or of the flexor digitorum profundus, also known as jersey fractures.<sup>[7,8]</sup> These can be associated with either small dorsal fragments or larger articular fragments with volar subluxation of the volar fragment [Figure 4]. Conservative management is usually the standard of treatment. Fractures of the PP in the hand are difficult to treat due to the presence of an important joint on either end of this bone. Important flexor and extensor tendons cross this bone for distal attachment.<sup>[9,10]</sup> The aim of the treating surgeon is not only to achieve timely union with good alignment but also to preserve the gliding mechanisms of these tendons. Usually, in the sagittal plane, the fracture adapts a palmar apical configuration with the proximal fragment in flexion and the distal fragment in extension. This is because the

intrinsic muscles flex the MCP joint; hence, the proximal fragment is in flexion. The distal fragment goes into extension due to the short excursion of the extensor tendon hood and lateral bands. When reduced properly, the fracture can be held using a splint with traction and the stabilizing effect of tense soft tissue. The treatment options include ORIF, external fixators, and conservative modalities [Figure 5]. ORIF can cause further soft tissue damage which can result in impairment of the gliding layers. However, surgical management becomes necessary in unstable, irreducible and open fractures with soft tissue damage.<sup>[11-13]</sup>

## CONCLUSION

For most stable fractures, conservative treatment modalities are sufficient, but for most unstable fractures, surgical treatment gives the better results. Conservative treatment is a reliable, inexpensive modality, especially in children and in elderly age groups, but is associated with complication of malunion. External fixator for hand injuries is a cheap, technically less demanding and effective procedure. This procedure is mainly used in comminuted and intra-articular fractures. This procedure not only corrects the deformity but also at the same time keeps the joint surface apart, thereby avoiding any crushing force on the bone cartilage. Furthermore, this is being a semi-invasive procedure; it does not require bone and soft tissue resection.

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# Prospective Non-randomized Case Study of Visual Outcome after Cataract Surgery in Diabetes Mellitus

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## Abstract

**Introduction:** Cataract is the most common cause of ocular morbidity in the Indian population, among which a major portion of people are having diabetes mellitus.

**Aim:** This study aims to assess the visual outcome after cataract surgery in those who are having diabetes mellitus.

**Materials and Methods:** A prospective study was conducted from July 2017 to September 2017 among 150 patients who were presented to the Ophthalmology Outpatient Department in Government Theni Medical College, Theni, and who were admitted and operated in ophthalmology inpatient ward. We used the data based on clinical evaluation as well as from various ophthalmologic equipments and from our central laboratory.

**Results:** Out of 150 patients studied, 42 were diabetic and among which 3 were having diabetic retinopathy, and their post-operative visual outcome was highly satisfactory.

**Conclusion:** Our study shows that the public are unaware of the ocular complications that may occur in type 2 diabetes mellitus as a result of which they present to the ophthalmology OPD too late even in the presence of marked loss of vision. Hence, the urgent need for public education about diabetes and its ocular complications are advised.

**Key words:** Cataract, Diabetic retinopathy, Visual acuity

## INTRODUCTION

Cataract remains the single largest cause of blindness among the Indian as well as among the global population. There is an estimated figure of 17.6 million (39%) people who are blind due to curable cataract.<sup>[1]</sup> Among the causes of acquired cataract, type 2 diabetes mellitus carries a major share being the 5<sup>th</sup> most common cause of legal blindness.

According to the WHO, there is an estimated 65% increase in diabetics by 2025 to 380 million which further imply a proportionate increase in number of cataract patients having diabetes mellitus.<sup>[2]</sup> Cataract occurs at an early age

and 2–5 times more frequently in patients with diabetes mellitus. Thus, the visual loss has a significant impact on the working population.<sup>[3]</sup>

The metabolic abnormalities taking place during the course of progression of type 2 diabetes mellitus provide a better ground for cataract to develop too early in relatively younger individuals.<sup>[5]</sup>

The osmotic over hydration of lens occurs due to the accumulation of sorbitol when glucose is metabolized by NADPH + dependent aldose reductase which further leads to the development of mature diabetic cataract.<sup>[4]</sup> These kinds of cataracts are mainly characterized by cortical or posterior subcapsular opacities [Figures 1 and 2].

## MATERIALS AND METHODS

A prospective study was conducted in Government Theni Medical College, Theni, from July 2017 to September 2017 among 150 patients who were presented to our ophthalmology

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outpatient department were admitted and operated for cataract after blood sugar control by administering parenteral insulin with the help of diabetologist.

The data were collected from clinical examination, slit lamp examination, and from our central laboratory for blood sugar values. After the diagnosis of cataract was made by thorough clinical examination, the patient was sent to slit lamp examination room and further to central laboratory. Then, they were duly operated and post-operative visual status assessed. The data obtained were analyzed statistically by simple proportions.

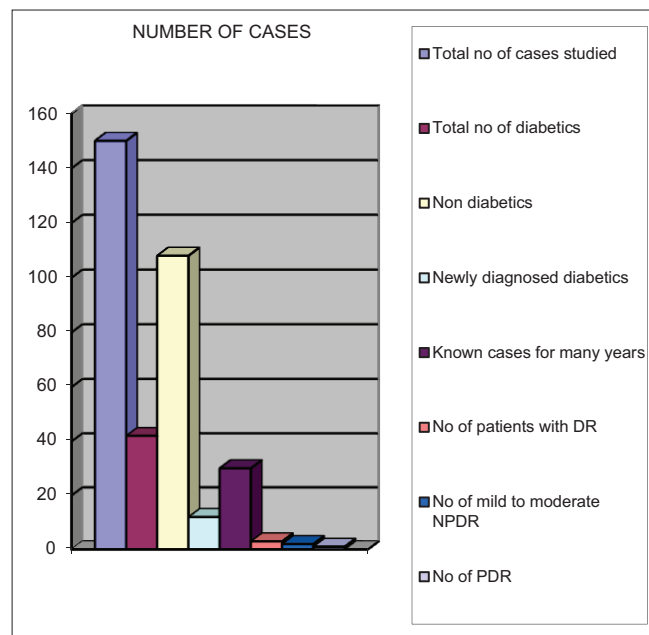
## RESULTS AND DISCUSSION

Of 150 cataract patients studied, there were 59 male patients and 91 female patients. Among these, 42 were diabetic which includes 17 male and 25 females. Of 42 diabetic cases, 15 patients (35.7%) were belonging to the age group of 61–70 years and 14 patients were belonging to 51–60 years of age group. Of these 42, 3 patients had diabetic retinopathy.

**Table 1: Number of cases**

Overall data analysis	No of patients
Total number of cases studied	150
Total number of diabetics	42
Non-diabetics	108
Newly diagnosed diabetics	12
Known cases for many years	30
Number of patients with DR	3
Number of mild to moderate NPDR	2
Number of PDR	1

NPDR: Non-proliferative diabetic retinopathy, PDR: Proliferative diabetic retinopathy, DR: Diabetic retinopathy



Among the diabetic patients, visual acuity by the time they presented to the ophthalmology outpatient department was recorded. Results showed that 18 patients who carry a major share among the diabetics were having a visual acuity range of CFCF to PL+ which also includes the three patients with diabetic retinopathy. Other 17 patients were having a visual acuity range of 6/60–1/60 and only one patient was in a better vision range of 6/18–6/36.

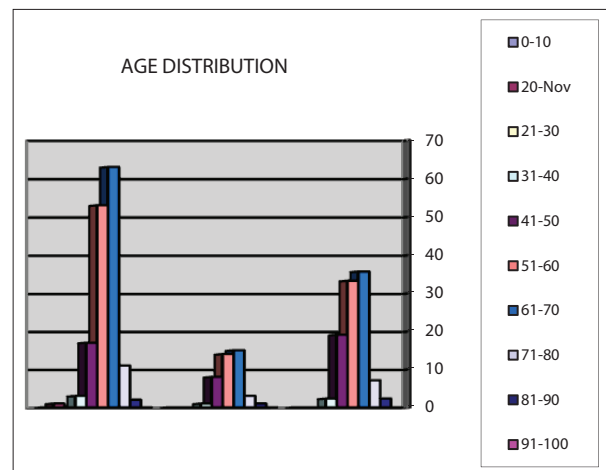
After diabetic control, every patient was operated and post-operative visual acuity was recorded. Of 42 patients who had undergone surgery, 31 patients were having a visual outcome of 6/9–6/18, and 7 patients were having a visual acuity range of 6/24–6/36. Only four patients had a post-operative visual acuity range in between 6/60 and 1/60, and among these, three patients had diabetic retinopathy for whom the prognosis was explained preoperatively [Tables 1-4].

## CONCLUSION

Our study shows that there is an increased prevalence of cataract among diabetic patients. The post-operative visual outcome was highly satisfactory for every patient except for those who were having diabetic retinopathy.

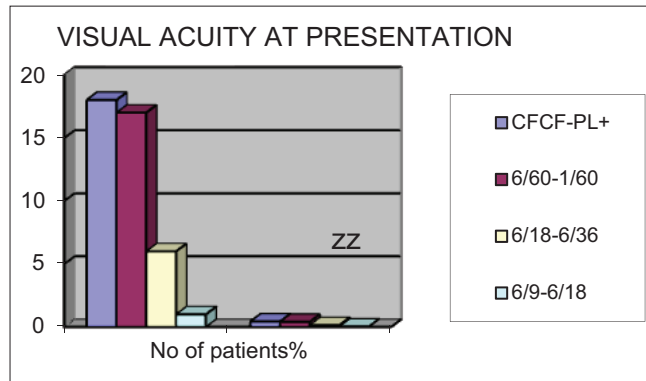
**Table 2: Age distribution**

Age group (year)	Number of patients	Number of diabetics	Percentage
0–10	0	0	0
20–Nov	1	0	0
21–30	0	0	0
31–40	3	1	2.3
41–50	17	8	19.1
51–60	53	14	33.3
61–70	63	15	35.7
71–80	11	3	7.1
81–90	2	1	2.3
91–100	0	0	0



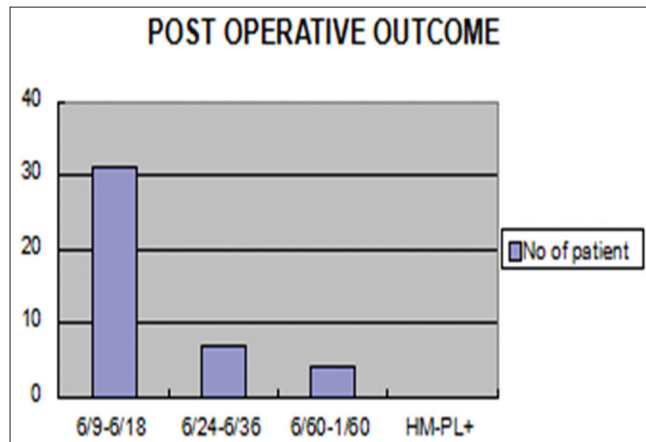
**Table 3: Visual acuity at the time of presentation among diabetics**

Range	Number of patients (%)
CFCF-PL+	18 (42.8)
6/60–1/60	17 (40.4)
6/18–6/36	6 (14.2)
6/9–6/18	1 (2.3)

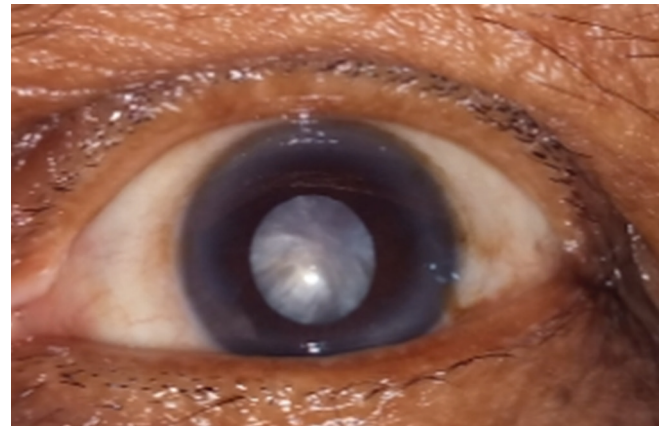
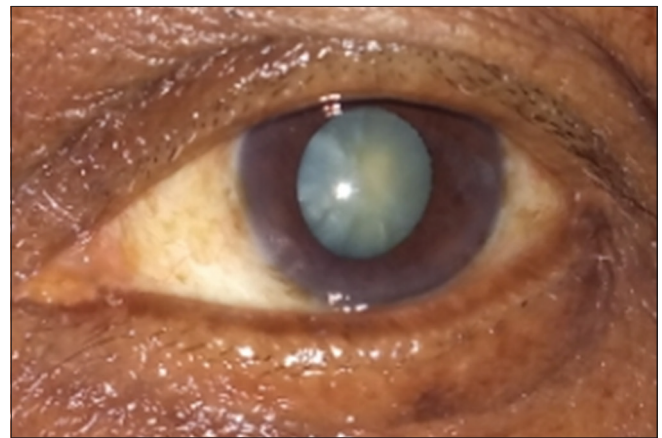
**Table 4: Post-operative visual outcome**

Range	Number of patients
6/9–6/18	31
6/24–6/36	7
6/60–1/60	4 (3 are with DR)
HM-PL+	0

DR: Diabetic retinopathy



The visual acuity by the time they presented to the OPD showed that there is a very poor awareness among the public about the ocular complications that may occur in type 2 diabetes mellitus, as a result of which they are not at all bothered about the gradual loss of vision they are undergoing and they are presenting to the OPD only whenever one or both of the eyes become nearly blind.

**Figure 1: Mature diabetic cataract****Figure 2: Hypermature diabetic cataract**

Hence, the public can be educated about the ocular complications that may occur in type 2 diabetes mellitus and the necessity of keeping their blood sugar values under control. The village health nurses and health inspectors can give orientation classes to every area and conduct medical camps for them to screen those patients with diabetic cataract and diabetic retinopathy, who might be unaware of their blood sugar status.

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# A Clinical Study of Prevalence of Myopia in School Going Children in Kakinada City

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## Abstract

**Background:** Refractive error is being the most common cause of visual impairment, in that myopia is the commonest cause. Myopia is a common vision condition affecting nearly 30% of population. It occurs more frequently among school children aged between 8 and 12 years. Because the eye continues to grow during childhood, it typically progresses until about age 20. Uncorrected myopia is a major public eye health problem in school-going children in India. Refractive error, and particularly myopia, places a substantial burden on the individual and on society. Therefore the magnitude of the problem needs to be assessed scientifically.

**Objectives:** This study evaluates the prevalence of myopia in school-going children in Kakinada City of Andhra Pradesh.

**Methods:** Simple random sampling among school-going children between 7 and 15 years of age were chosen for the study. Among the schools in Kakinada city, 6 schools were randomly selected for the study for a period of 1 year from January 1<sup>st</sup>, 2015 to December 31<sup>st</sup>, 2015. A detailed history regarding the personnel details, any presenting complaints, past history of wearing glasses was taken. The examination included thorough ocular torch light examination with special concentration to the visual axis by performing Hirschberg's test. A visual acuity cut off of 6/9 was taken.

**Results:** A total of 1,029 students were participated in study. The prevalence of myopia was found in 7.48% students. Increasing age was associated with the increased risk of having myopia. Girl students were more likely to have myopia than boys. The prevalence of myopia among girls was more than that of boys 8.2% and 6.68% respectively.

**Conclusion:** Simple myopia which is very common in school-going children is often remains undetected and is a leading cause of visual impairment for school students. Early detection and proper optical correction can prevent the morbidity due to myopia.

**Key words:** Myopia, Optical correction, Refractive error, School going children

## INTRODUCTION

It is estimated that there are 1.4 million blind children in the world, two thirds of whom live in the developing countries,<sup>[1]</sup> and that the causes of blindness in children vary according to region and socioeconomic development.<sup>[1,2]</sup> There are 12.9 million children in the age group of 5–15 years who are visually impaired from uncorrected or inadequately

corrected refractive errors, a global prevalence of 0.96%, with the highest prevalence reported in urban and highly developed urban areas in South-East Asia.<sup>[3]</sup> Many of the causes of blindness in children are either preventable or treatable.

The incidence of blindness in children is very difficult to ascertain, requiring either very large longitudinal studies, accurate registers of the blind, or reliable active surveillance systems.<sup>[4]</sup> Since in developed countries the majority of children attend schools or preschools, it is relatively easier to reach them by vision screening programs. However, in developing countries many children do not attend school, and they are therefore missed by vision screening programs conducted in schools.

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For the age group 5–15 years, the prevalence of visual impairment from uncorrected refractive errors in some regions appears to be higher in urban areas than in rural areas, despite access to service. This may be due to a high incidence of myopia in these populations: It is suggested that there may be a direct cause-effect relation between increased access to education and myopia, but other secular changes could be contributing factors.<sup>[3]</sup>

Uncorrected myopia is major public eye health problem in school-going children in India. School myopia occurs at approximately 7–17 years of age and stabilizes by the late teens or early twenties. Over the past few decades, there has been an increase in the prevalence of myopia in some population, leading to growing concern among the public and the scientific community. There is no well-established or universally accepted treatment for the prevention of myopia onset or progression.<sup>[5]</sup>

The importance of early detection and treatment of visual impairment in children in India is obvious, because 30% of these blind children lose their sight before 20 years of age.<sup>[6]</sup> Poor vision in childhood affects performance in school or at work and has a negative influence on the future life of the child.<sup>[7]</sup>

Ninety seven percent of all visual disabilities are preventable or treatable. Refractive error is the commonest type of ocular morbidity and myopia is the commonest type of refractive error as opposed to hypermetropia.<sup>[8]</sup> As myopia is the most prevalent in school going children (7–15 years of age), the visual morbidity can be reduced by early detection through screening programs in school. Hence, these screening programs with treatment should be promoted in all schools.

The schools in Kakinada are randomly selected and screened using snellen's chart for distant vision, near vision charts, torch light examination, retinoscopy by Heine streak retinoscopy, distant direct and direct ophthalmoscopy and subjective testing using Trial frame and trial set of lenses.

## Review of Literature

Aristotle (384–322 BC) was the first to describe short sight while it was only Galen (130–200AD) who attempted to put the problem of myopia within the physiological concepts of his days, the theory of humours. The optics of myopia was first elucidated by Johannes Kepler (1604) in his initial clarification of ophthalmic dioptrics when he correctly assumed that the incident light was brought to focus in front of retina. Von-Graefe (1954) was the first to correlate the ophthalmoscopic and degenerative changes of pathological myopia.<sup>[9]</sup>

The prevalence of myopia varies by the country, age and by ethnic group it is a major cause of visual impairment in both the developed and the developing world.<sup>[10]</sup>

The prevalence of myopia has been reported to be as high as 70–90% in some Asian population with Taiwan reporting a myopic prevalence of 84% among 16–18 years old high school students.<sup>[11,12]</sup> In Europe and America, its prevalence varies between 30% and 40%, while in Africa 10–20% of the population is affected.<sup>[13]</sup> Myopia affects 25% of the population United States.<sup>[14]</sup>

In some parts of Asia, myopia is very common. Singapore is believed to have the highest prevalence of myopia in the world; up to 80% of people there have myopia, but the accurate figure is unknown.<sup>[15]</sup> China's myopia rate is 31% which shows 400 million of its 1.3 billion people are myopic. The prevalence of myopia in high school of China is 77.3%, and in college is more than 80%.<sup>[16]</sup>

However, some research suggests the prevalence of myopia in India in the general population is only 6.9%.<sup>[17]</sup>

Kalivayayi *et al.*, in 1997 studied 4,029 children between 3 and 18 years in Hyderabad city, India, prevalence of myopia to be 8.6% and was significantly higher in children around 10 years of age ( $P < 0.00$ ), supporting vision screening of school children in developing countries could be useful in detecting correctable causes of decreased vision in minimizing long term permanent visual disability. The most important cause of uncorrectable visual loss in this study was found to be amblyopia, mostly caused by refractive errors.<sup>[18]</sup>

Murthy *et al.*, in 2002 assessed the prevalence of refractive error and related visual impairment in school going children 5–15 years of age, in an urban population in New Delhi and reported a prevalence of 7.4% of myopia.<sup>[19]</sup>

Fan *et al.*, in 2004 screened 7,560 Chinese children in Hong Kong of mean age 9.33 years range between 5 and 16 years, has found myopia the most common refractive error, and was found in 36.7%+2.87% of children, prevalence of myopia correlated positively with older age. Children aged 11 years were almost 15 times more likely to have myopia than children younger than 7 years. Increasing age was correlated with increased incidence of myopia with highest risk in children of aged 11 years.<sup>[20]</sup>

Uzma *et al.*, in 2009 conducted study in Hyderabad on school-aged children in urban and rural population showed provision of health education, periodic visual screening programs and primary eye care by trained health care personnel in elementary schools will help to detect early

diagnosis of Myopia and common ocular diseases in school children.<sup>[21]</sup>

Ghosh *et al.*, in 2012 conducted study in Kolkata on 2570 children of 10 primary schools. The age range was 6–14 years; refractive error was seen in 14.7%. Myopia was present in 307 (11.9%) visual acuity of  $<6/12$  in better eye was present in 109 (4.2%) and 5 (0.2%) children pre and post-correction respectively.<sup>[22]</sup>

## MATERIALS AND METHODS

### Sampling Area

This is a cross sectional and time bound study in which simple random sampling among schools in Kakinada city was done.

### Sampling Population

All the children between 7 and 15 years of age in the selected schools were examined for visual impairment from January 1<sup>st</sup>, 2015 to December 31<sup>st</sup>, 2015.

The purpose and methods of examination of students were explained to the head of the schools concerned. A large room capable of distant vision assessment is taken. With the help of the respective class teachers each class was subjected to visual acuity tests, student by student. After obtaining consent from parents students were subjected for vision screening. The students whose visual acuity was observed to be 6/9 or less was again subjected to visual acuity testing.

These students were subjected to torch light examinations, cycloplegic refraction by streak retinoscopy and fundus examination. Refractive errors and other ailments of the eye were treated wherever necessary. The condition and prognosis were explained to the parents through the teachers. Data was recorded and analyzed.

### Sample Selection

Mandal education officer, Kakinada was approached with the requisition for the permission of collection of data. It was decided to have a simple random sampling. The list of schools in Kakinada city was obtained; primary school and high schools were numbered separately. The chits bearing the numbers were rolled and put in a box. Ten schools were selected

The selected schools list were instructed by the Mandal education officer, Kakinada to co-operate in the ophthalmic examination of the students and separate requisition letters to each school from professor and Head of the department were also given.

### Sample Size

Sample size is estimated using 7% of prevalence with 80% confidence interval at 1% error level and the minimum sample for the above mentioned criteria is 925. The size of sample taken was 1.029 children which is more than that of the minimum requirement.

## OBSERVATIONS AND RESULTS

- Total number of children screened 1.029
- Total number of schools visited 10 [Table 1].

In our study total 1.029 students were screened among them 77 students had myopia. Prevalence of myopia was found to be 7.48%.

Among 77 children 45 (8.12%) were girls. In this study, prevalence of myopia was found to be more amongst girls than boys.

Chi-square test for all the demographic parameters is found to be no-significant as shown in Table 2.

The least prevalence of myopia was found in II class (4.1%) and highest prevalence was found in X class (11.7%). General observation was that the prevalence of myopia was more in older students [Table 3].

In our study 154 eyes of 77 students, 4 eyes had no refractive error. So, considering 150 myopic eyes 32 (21.3%)

**Table 1: Characteristics of school children surveyed from Primary School of Kakinada in the year 2015**

Sex	n (%)
Male	475 (53.8)
Female	554 (46.2)
Age	
7	84 (8.2)
8	124 (12.1)
9	120 (11.7)
10	108 (10.5)
11	134 (13.0)
12	147 (14.3)
13	115 (11.2)
14	103 (10.0)
15	94 (9.1)
Standard	
2	96 (9.3)
3	112 (10.9)
4	120 (11.7)
5	108 (10.5)
6	134 (13.0)
7	147 (14.3)
8	115 (11.2)
9	103 (10.0)
10	94 (9.1)
Total	1029

**Table 2: Prevalence of myopia by age, sex, standard of study**

Characteristics	Total numbers	Prevalence number	Percentage of prevalence (%)	Chi-square value
Sex				
Male	475	32	6.74	0.842 (non-significant)
Female	554	45	8.12	
Age				
7	84	5	5.95	4.319 (non-significant)
8	124	8	6.45	
9	120	6	5.00	
10	108	6	5.56	
11	134	9	6.72	
12	147	12	8.16	
13	115	10	8.70	
14	103	10	9.71	
15	94	11	11.70	
Standard				
2	96	4	4.1	5.381 (non-significant)
3	112	5	4.4	
4	120	7	5.8	
5	108	7	6.4	
6	134	10	7.4	
7	147	12	8.1	
8	115	10	8.6	
9	103	11	10.67	
10	94	11	11.7	

eyes had visual acuity 6/18 at least in one eye before correction was found to be high and 2 (1.3%) eyes had visual acuity CF3m at least in one eye before correction was found to be lowest [Table 4].

After optical correction, the corrected visual acuity was almost near normal in most of the eyes 144 (96%), 5 (3.3%) eyes had distant vision (6/9) and 1 (0.6%) eye had distant vision (6/12) even after correction. This could be due to possible amblyopia [Table 5].

In our study out of 77 cases, 73 (94.8%) students had bilateral myopia. Only 4 (5.19%) students had unilateral myopia.

In total of 150 eyes, 115 (76.7%) eyes had a refractive error of <-3.0 D. 29 (19.3%) eyes were between -3 and -6 D myopia and 6 (4%) eyes were >-6 D myopia.

In total of 150 eyes, 14 (9.3%) eyes had Simple myopic astigmatic refractive error and 32 (21.3%) eyes had compound myopic astigmatic refractive error.

In our study out of 150 eyes, 8 (5.3%) eyes found to have pathological myopia changes. Among them 2 (25%) eyes had large disc with temporal crescent, 1 (12.5%) eyes had only temporal crescent. 2 (25%) eyes had large disc, temporal crescent and super traction. 1 (12.5%) eye had large disc, annular crescent, super traction and degenerative changes. 1 (12.5%) eye had large disc, annular crescent and super traction. 1 (12.5%) eyes had large disc, temporal crescent, super traction and degenerative changes [Table 6].

**Table 3: Visual acuity among the school children at the time of survey (before correction)**

VA	Number of eyes (%)
6/9	36 (24)
6/12	26 (17.3)
6/18	32 (21.3)
6/24	34 (22.6)
6/36	10 (6.6)
6/60	6 (4)
CF3m	2 (1.3)
CF4m	2 (1.3)
CF5m	2 (1.3)
Total	150 (100)

**Table 4: Visual acuity among the school children (after correction)**

Corrected VA	Number of eyes (%)
6/6	144 (96)
6/9	05 (3.3)
6/12	01 (0.6)
Total	150 (100)

In total of 150 eyes, 96 (64%) eyes had Simple myopic refractive error and 8 (5.3%) eyes had Pathological myopia. Overall simple myopia was found to be more than pathological myopia.

## DISCUSSION

The present study can be discussed considering the following criteria.

**Table 5: Characteristics of myopia among the school children**

Characteristics	Total number	Numbers of cases (%)
Laterality		
Unilateral	77	4 (5.19)
Bilateral		73 (94.8)
Degree of myopia		
<-3.0D (mid)	150	115 (76.7)
<-3.0D (mid)		29 (19.3)
<-3.0D (mid)		06 (04)
Condition of myopia		
Simple	150	96 (64)
Pathological		08 (5.3)
Astigmatism		
Simple	150	14 (9.3)
myopic		
Compound		32 (21.3)
myopic		
Fundus change		
DL, TC	150	02 (25)
TC		01 (12.5)
DL, TC, ST		02 (25)
DL, AC, ST, DG		01 (12.5)
DL, AC, ST		01 (12.5)
DL, TC, ST, DG		01 (12.5)

DL: Large disc, TC: Temporal crescent, ST: Super traction, AC: Annular crescent, DG: Degenerative changes

**Table 6: Means, standard deviation of degree of myopia among school children**

Severity	Mean±SD
Mild	-1.34±0.769
Moderate	-3.56±0.7789
Severe	-6.79±0.4852

SD: Standard deviation

### Sex Distribution

In our study, the prevalence of myopia in girls was (8.2%) found to be more than that of the boys (6.68%). A study conducted on Greek students between 15 and 18 years in 1998 by Mavracanas *et al.*<sup>[23]</sup> Showed myopia to be more common in females (46%) than in males (29.7%). Our study also shows myopia prevalence is more for females (8.2%) than for males (6.68%).

### Class Wise Prevalence (Approximately Equalling Age)

In our study of 1029 students, it was found that students in higher standards had higher prevalence of myopia than students of lower standard. It was found that X class had 11.7% of prevalence and II class lowest prevalence 4.1%.

Study of Murthy *et al.*<sup>[19]</sup> shown prevalence of myopia correlated positively with older age, which is also comparable to our present study.

Dandona *et al.*<sup>[24]</sup> studied children between 7 and 15 years at Andhra Pradesh, India, and found the prevalence of myopia to be 4.1% and was significantly higher in children with older age; this was also comparable to our present study.

### Vision Improvement

In present study visual acuity <6/6 at least in one eye present in 77 students. Out of these 150 eyes, visual acuity improved to 6/6 with correction in 144 eyes (96%) which is comparable to our study. Only 6 eyes (4%) of 150 eyes did not improve to 6/6 with correction due to possibly developed amblyopia.

Study of Ghosh *et al.*<sup>[22]</sup> shown visual acuity <6/6 at least in one eye was present in 754 eyes. Out of these 754 eyes, visual acuity improved with correction in 712 eyes (94.4%).

### Types of Myopia

In our study, out of 150 eyes 96 (64%) eyes had simple myopia, 14 (9.3%) eyes had simple myopia astigmatism and 32 (21.3%) eyes had compound myopic astigmatism. Out of 77 cases, only 4 cases had unilateral myopia, rest of the cases had bilateral myopia.

Study by Ghosh *et al.*<sup>[22]</sup> shown out of 5139 eyes 370 (7.2%) eyes had simple myopia, 208 (4.05%) eyes had simple myopic astigmatism and 10 (0.2%) eyes had compound myopic astigmatism.

Overall, simple myopia cases were found to be more than simple myopic astigmatism and compound myopic astigmatism in our study when comparing to the above study.

Sperduto *et al.*<sup>[25]</sup> in his study found prevalence rates of myopia were significantly lower for men than for women for all age.

### Myopia and Near Work

In present study, 77 myopic patients of school children there was a highly significant association between myopia and near work. It suggests that students of higher classes were spending significantly more time than the students of lower classes in the near-work activities.

A comparative study by Ip *et al.*<sup>[26]</sup> of 2353 patients between government and private schools, reported that girls were spending significantly more time than did the boys in the near-work activities of completing homework, reading books and using a computer. The study also showed that the prevalence of myopia in girl was (14.1%) with a greater tendency of myopic refraction and greater time spent in near-work activities.



In other study by Saw *et al.*<sup>[27]</sup> also showed increased near-work which contributed to prevalence of myopia.

## CONCLUSION

Observations and results showed that simple myopia is more common in school going children. Majority of the cases were detected only during the screening of the students. So, majority of them go unnoticed, making more students visually handicapped.

But with the co-operation of the teachers, school authorities and medical staff, affected can be treated with proper optical correction, thereby reducing morbidity due to myopia.

Thus an early diagnosis and visual rehabilitation of myopic students can be achieved by periodic eye examination at regular intervals by school teachers and basic health workers and educating them regarding optical correction of myopia thereby preventing the development of amblyopia which will definitely reduce the burden of morbidity due to myopia.

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# Awareness and Attitude of Parents toward Avulsed Permanent Tooth of their Children and its Emergency Management in Jammu Population

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## Abstract

**Aim:** The aim of the present study is to determine the awareness and attitude of parents toward avulsed permanent tooth of their children and its emergency management in Jammu population.

**Materials and Methods:** A total of 823 parents were selected for the study who accompanied their children, aged between 6 and 12 years, for receiving dental care for the first time in the Department of Pedodontics in Indira Gandhi Government Dental College and Hospital, Jammu, between June 2015 and September 2015. The participants were asked to complete a questionnaire which was a modified form of questionnaire used by Raphael and Gregory in their study. The questionnaire consisted of two parts with first part containing the demographic data and the second part containing questions to assess the knowledge, attitude, and previous experience of the participant regarding emergency care of avulsed permanent tooth. Completed questionnaire was collected and tabulated and statistical analysis was done using SPSS version 20.0.

**Results:** 52.7% of males and 47.3% of females were analyzed educational status (with majority of the subjects having educational qualification up to elementary school - 50.7%) and geographical background (58.2% of subjects were residents of urban areas). The various responses to questions regarding knowledge (K), attitude (A), previous information (P) of parents regarding emergency management of avulsed permanent tooth. 55.9% of subjects had knowledge about the possibility of reimplantation, and 28.31% of the subjects were having knowledge about self-reimplantation. Majority of the subjects (25.4%) responded for immediate reimplantation in Question K3. In Question K4, 30.62% of the subjects chose saline as the cleaning media. 31.9% responded for water as a transport media in Question K5. 69.1% of the subjects were not having previous information regarding the emergency management of avulsed teeth. 39.24% chose books as a source of information. 81.4% of the subjects were having a positive attitude for saving permanent tooth. Majority of the subjects (67.8%) chose dentist as the first place of contact. 59.1% of the subjects were having a previous experience of avulsion in their children.

**Conclusion:** It can be concluded that there is limited awareness regarding emergency management of the avulsed permanent teeth and various awareness programs should be conducted to educate parents about dental trauma and timely referral to the concerned professional.

**Key words:** Avulsion, Dental trauma, Reimplantation, Awareness

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## INTRODUCTION

Various epidemiological studies have reported dental trauma to be a significant problem which is expected to overshoot the incidence and prevalence of dental caries in young children.<sup>[1]</sup> Dental trauma in young children is often seen to occur accompanying trauma of orofacial

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region with varying range of complexities. This could vary from simple concussion to extensive maxillofacial damage involving periodontal structures or avulsion of teeth.<sup>[2]</sup> Among the dental injuries, avulsion of tooth is considered to be the most severe form of injury with a wide array of consequences affecting the dental and overall development of child, thus demanding prompt organized approach.

Dental avulsion is defined as complete removal of the tooth out of its socket. It causes severe damage to pulp and periodontal ligament tissues with or without fracture of the alveolar bone. Most common causes of dental trauma in children include fall during sports and leisure activities.<sup>[2,3]</sup>

An estimate of 0.5–16% of avulsions is seen in permanent dentition and 7–13% in primary dentition.<sup>[4-6]</sup>

Maxillary central incisors are most commonly affected with avulsion, both in primary and permanent dentition. These injuries are more common among boys when compared to girls as boys participate more in outdoor activities and sports.<sup>[7-11]</sup>

Andreasen modified the WHO classification of avulsion as an injury of periodontal tissues, as well as extrusive, lateral, or intrusive luxation.<sup>[12,13]</sup>

The prognosis of avulsed tooth is determined by adequate action taken immediately, which involves minimizing the time the tooth remains outside its socket, use of adequate storage and transportation medium and protecting the root surface and periodontal ligament from damage.

The International Association of Dental Traumatology, in 2012, published guidelines for the management of avulsed teeth, highlights the evidence-based approach to emergency care and is of great help for a dentist, health-care professionals, and parent in decision-making.<sup>[14]</sup>

Although there are various modalities to replace a lost tooth, the role of immediate reimplantation is still the most preferred and desired by parents, child, and clinicians.<sup>[15]</sup>

The reported success rate in immediate reimplantation ranges from 85% to 97% depending on the stage of root development. However, the success rate is dependent on factors such as extra-alveolar time in turn viability of periodontal ligament, storage and transport media, type of splinting, time of endodontic intervention, and oral and general health status.<sup>[16]</sup>

In case of an emergency of avulsed teeth, parents of the children are the first people to attend and make decisions. Awareness and knowledge of the parents in the handling of these emergency situations of avulsed teeth influence the prognosis of the teeth.

Parents can play a major role in improving the prognosis of avulsed permanent teeth of children if they are informed about the first aid steps to be taken at the time of an accident. Before planning information campaigns, it is important to assess the knowledge level of parents. The present study is, therefore, aimed to determine the awareness and attitude of parents toward avulsed permanent tooth of their children and its emergency management in Jammu population.

## MATERIALS AND METHODS

The study sample included of 823 parents who accompanied their children, aged between 6 and 12 years, for receiving dental care for the first time in the Department of Pedodontics in Indira Gandhi Government Dental College and Hospital, Jammu, between June 2015 and September 2015. A written informed consent form according to the ethical guidelines was subsequently obtained from the participating parents.

The participants were asked to complete a questionnaire which was a modified form of questionnaire used by Raphael and Gregory<sup>[17]</sup> in their study. The questionnaire was provided in both simple English and Hindi language. The questionnaire consisted of two parts with first part containing the demographic data and the second part containing questions to assess the knowledge, attitude, and previous experience of the participant regarding emergency care of avulsed permanent tooth. Completed questionnaire was collected and tabulated and statistical analysis was performed using SPSS version 20.0. This was followed by distribution of information leaflets and health education regarding emergency management of avulsed young permanent teeth to the participants.

## RESULTS

Table 1 presented the demographic distribution of the subjects according to their gender (52.7% males and 47.3% females), educational status (with majority of the subjects having educational qualification up to elementary school - 50.7%), geographical background (58.2% of subjects were residents of urban areas). Table 2 showed various responses to questions regarding knowledge (K), attitude (A), and previous information (P) of parents regarding emergency management of avulsed permanent tooth. 55.9% of subjects had knowledge about the possibility of reimplantation, and 28.31% of the subjects were in favor of self-reimplantation. Majority of the subjects (25.4%) responded for immediate reimplantation in Question K3. In Question K4, 30.62% of the subjects chose saline as the cleaning media. 31.9% responded for water as a transport media in Question K5. 69.1% of the

subjects were not having previous information regarding the emergency management of avulsed teeth. 39.24% chose books as a source of information. 81.4% of the subjects were having a positive attitude for saving permanent tooth. Majority of the subjects (67.8%) chose dentist as the first place of contact. 59.1% of the subjects were having a previous experience of avulsion in their children. The male participants showed more positive response toward knowledge and emergency management of avulsed teeth.

**Table 1: Demographic data**

Variables	Frequency (%)
Gender	
Male	434 (52.7)
Female	389 (47.3)
Education status	
Illiterate	73 (8.9)
Elementary School	417 (50.7)
Higher Secondary	227 (27.6)
Graduation and above	106 (12.9)
Geographical Background	
Rural	344 (41.8)
Urban	479 (58.2)

## DISCUSSION

The aim of the present study was to determine the awareness and attitude of parents toward avulsed permanent tooth of their children and its emergency management in Jammu population.

The findings of our study showed that male participants were having more awareness toward the possibility of reimplantation of avulsed permanent teeth which is in accordance with various other studies.<sup>[18-24]</sup>

71.7% of the parents were not in favor of self-reimplantation. Similar results were obtained by the studies done by Shashikiran *et al.*, Namdev *et al.*, Loo *et al.*, Abdellatif and Hegazy, Santos *et al.*, Ayodele *et al.*, Al-Jame *et al.*, Ozer *et al.*, and Jain *et al.*<sup>[18-25]</sup> However, the results of our study are not in agreement with the studies done by Raphael and Gregory as they reported that about 75% of participants were willing for attempting self-reimplantation.<sup>[17]</sup>

The findings of our study showed that 30.62% of the participants chose saline, followed by water (25.8%),

**Table 2: Response of parents regarding emergency management of avulsed permanent tooth**

Questions	Answers	Male (%)	Female (%)	Total (%)	P
K1 possibility of reimplantation	Yes	243 (29.5)	217 (26.4)	460 (55.9)	0.9891
	No	191 (23.21)	172 (20.9)	363 (44.1)	
K2 self-reimplantation	Yes	107 (13.0)	126 (15.31)	233 (28.31)	0.0139
	No	327 (39.7)	263 (31.96)	590 (71.7)	
K3 timing of reimplantation	Immediately	113 (13.73)	96 (11.7)	209 (25.4)	0.7049
	As bleeding stops	87 (10.6)	74 (8.9)	161 (19.6)	
	Within 1 h	98 (11.9)	83 (10.1)	181 (21.9)	
	Within 24 h	59 (7.2)	67 (8.1)	126 (15.31)	
	After 5 days	77 (9.4)	69 (8.4)	146 (17.7)	
K4 cleaning media	Water	117 (14.22)	96 (11.7)	213 (25.8)	0.6301
	Saline	139 (16.89)	113 (13.7)	252 (30.62)	
	Milk	48 (5.8)	51 (6.2)	99 (12.01)	
	Saliva	71 (8.6)	67 (8.14)	138 (16.77)	
	Nothing	59 (7.2)	62 (7.5)	121 (14.7)	
K5 transport media	HBSS	25 (3.03)	23 (2.8)	48 (5.8)	0.8819
	Water	147 (17.9)	116 (14.1)	263 (31.9)	
	Saline	87 (10.6)	83 (10.1)	170 (20.7)	
	Milk	83 (10.1)	82 (9.9)	165 (20.04)	
	Nothing	39 (4.7)	38 (4.6)	77 (9.4)	
K6 previous information	Handkerchief	53 (6.4)	47 (5.7)	100 (12.2)	0.0485
	Yes	147 (17.9)	107 (13.0)	254 (30.9)	
K7 source of information	No	287 (34.9)	282 (34.3)	569 (69.1)	0.0558
	Books	174 (21.14)	149 (18.10)	323 (39.24)	
	Media	127 (15.4)	103 (12.5)	230 (27.9)	
	Newspaper	39 (4.7)	59 (7.2)	98 (11.9)	
	Web	94 (11.4)	78 (9.5)	172 (20.9)	
A1 necessary for saving permanent tooth	Yes	379 (46.1)	291 (35.4)	670 (81.4)	0.0000
	No	55 (6.6)	98 (11.9)	153 (18.6)	
A2 first place of contact	Dentist	337 (40.9)	221 (26.9)	558 (67.8)	0.0000
	Hospital	39 (4.7)	71 (8.6)	110 (13.4)	
	General practitioner	58 (7.0)	97 (11.8)	155 (18.8)	
P1 previous experience of avulsion	Yes	279 (33.9)	207 (25.2)	486 (59.1)	0.0013
	No	155 (18.8)	182 (22.1)	337 (40.9)	



whereas only 12.01% of the subjects preferred milk for cleaning a soiled avulsed tooth, which were in accordance with the findings of Jain *et al.* Similarly, Abdellatif and Hegazy and Al-Jame *et al.* concluded that there was a lack of knowledge regarding cleansing medium.<sup>[20,23]</sup>

In the present study, when asked about appropriate transport media, majority of the subjects (31.9%) chose water, followed by saline (20.7%) and milk (20.04%). In our study, the number of subjects choosing milk and saline were almost equal which is not similar to the previous study done by Jain *et al.*<sup>[25]</sup> A very less number (5.8%) of the respondents have chosen hanks' balanced salt solution (HBSS) as the appropriate media.

30.9% of participants gave a positive response when asked about the previous information regarding tooth avulsion which is similar with the findings of Jain *et al.* and Shashikiran *et al.*, who reported that most of the parents did not receive any previous information about emergency management of avulsed permanent tooth.<sup>[25,26]</sup>

The limitation of the present study is that knowledge and attitude of the subjects toward the management of avulsed permanent teeth based on their educational qualification and geographic area were not considered although majority of the subjects were having educational qualification up to elementary school and were residing in urban areas.

## CONCLUSION

It can be concluded that there is limited awareness regarding emergency management of the avulsed permanent teeth and various awareness programs should be conducted to educate parents about dental trauma and timely referral to the concerned professional.

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# Gender Differences for Deciduous Molar Sizes in Children of Jammu City

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## Abstract

**Aim:** The aim of this study is to determine the gender differences for the size of deciduous molars in children of Jammu city.

**Materials and Methods:** Of 893 children with age ranging from 6 to 11 years who visited the Department of Pediatric and Preventive Dentistry in Indira Gandhi Government Dental College, Jammu, from July 2016 to October 2016, 100 children were selected based on the inclusion criteria which were further divided into two groups. Group I included 50 males and Group II included 50 females. All the selected samples were initially subjected to oral prophylaxis, impressions were made with alginate, and casts were pored immediately with dental stone and the study models were prepared. The models thus obtained were finished and numbered for ease of identification. Electronic digital caliper calibrated to the nearest 0.01 mm was used to measure the mesiodistal and buccolingual dimensions of primary molars (both D and E) following the evaluation criteria. The evaluated result was then subjected to statistical analyses.

**Results:** The mean dimension of upper first molar is 6.29mm, and in females, it is 6.27 mm. The mean buccolingual measurement for upper first molar in males is 8.77 mm and in females is 8.64 mm. The mean mesiodistal measurement for the upper second molars is 8.57 mm in males and 8.66 mm in females. Their mean buccolingual measurement was 9.71 mm in males and 9.70 mm in females. The mean dimension of lower first molar is 7.49 mm, and in females, it is 7.37 mm. The mean buccolingual measurement for lower first molar in males is 7.78 mm and in females is 7.46 mm. The mean mesiodistal measurement for the lower second molars is 9.52 mm in males and 9.27 mm in females. The mean buccolingual measurement in males was 9.11 mm and 8.78 in females.

**Conclusion:** The dimensions of primary molars are slightly larger in males in comparison to females. The data about these measurements have an anthropological significance to differentiate various genders in different populations.

**Key words:** Occlusion, Deciduous molars, Gender, Measurements, Dimorphism

## INTRODUCTION

Deciduous teeth, forming from the first trimester until about 3 years of age, are a record of prenatal development. They also express genetic traits and may reflect environmental effects including maternal health, childhood disease, and nutrition.<sup>[1]</sup>

Deciduous teeth erupt until about 30 months of age, and their replacement begins around 6 years of age, being completed by around 12 years of age.<sup>[2,3]</sup>

Primary teeth play an important role in growth and development of children. Attempts to maintain the primary teeth until the eruption of their permanent successors have resulted in the introduction of many restorative materials and techniques.<sup>[4,5]</sup>

Tooth size provides a perception of connection between populations and environmental adaptation. The relationship between tooth size and dental crowding is reported by researchers as being an important factor in clinical practice.<sup>[6-11]</sup>

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Tooth size in humans is determined by polygenic genetic factors. The environmental influences include particularly the socioeconomic conditions, ethnicity, nutrition, childhood health, and maternal aspects such as gestational conditions and systemic factors.<sup>[7]</sup>

The aim of the present study is to determine the gender differences for the size of deciduous molars in children of Jammu city.

## MATERIALS AND METHODS

Of 893 children with age ranging from 6 to 11 years who visited the Department of Pediatric and Preventive Dentistry in Indira Gandhi Government Dental College, Jammu, from July 2016 to October 2016, 100 children were selected based on the inclusion criteria which were further divided into two groups. Group I included 50 males and Group II included 50 females.

### Inclusion Criteria

The following criteria were included in the study:

- Children residing in Jammu city.
- Same ethnicity of ancestors.
- Fully erupted, sound and caries free deciduous molars.

### Exclusion Criteria

The following criteria were excluded from the study:

- Anomalies of tooth size and shape.
- Partially erupted deciduous molars.
- Carious deciduous molars.
- Restored deciduous molars.

All the selected samples were initially subjected to oral prophylaxis, impressions were made with alginate, and casts were pored immediately with dental stone and the study models were prepared. The models thus obtained were finished and numbered for ease of identification. Electronic digital caliper calibrated to the nearest 0.01 mm was used to measure the mesiodistal and buccolingual dimensions of primary molars (both D and E) following the evaluation criteria put forth by Barbería *et al.*<sup>[12]</sup>

- Mesiodistal measurement: The distance between the mesial and distal points of contact measured with the caliper placed parallel to the occlusal surface.
- Buccolingual measurement: The maximum width between the buccal and lingual surfaces measured with a digital caliper placed perpendicular to the mesiodistal size.

All the measurements were noted by a single examiner and the values thus obtained were tabulated and subjected to statistical analysis using the statistical package for social sciences SPSS version 20.0.

## RESULTS

Table 1 presents that the mean dimension of upper first molar is 6.29 mm, and in females, it is 6.27 mm. The mean buccolingual measurement for upper first molar in males is 8.77 mm and in females is 8.64 mm. The mean mesiodistal measurement for the upper second molars is 8.57 mm in males and 8.66 mm in females. Their mean buccolingual measurement was 9.71 mm in males and 9.70 mm in females. The gender differences between the mean buccolingual and mesiodistal measurements were statistically insignificant.

Table 2 summarized that the mean dimension of lower first molar is 7.49 mm, and in females, it is 7.37 mm. The mean buccolingual measurement for lower first molar in males is 7.78 mm and in females is 7.46 mm. The mean mesiodistal measurement for the lower second molars is 9.52 mm in males and 9.27 mm in females. The mean buccolingual measurement in males was 9.11 mm, which is slightly larger in comparison to mean buccolingual dimension in females (8.78 mm). However, the gender differences between the mean buccolingual and mesiodistal measurements were statistically insignificant.

## DISCUSSION

The study was conducted in 893 children with age ranging from 6 to 11 years who visited the Department of Pediatric and Preventive Dentistry in Indira Gandhi Government Dental College, Jammu, from July 2016 to October 2016,

**Table 1: Mean sizes of deciduous upper molars among different groups**

Tooth	Dimension	Group I 50 males		Group II 50 females		P
		X	SD	X	SD	
Upper first molar	MD	6.29	0.43	6.27	0.41	1.2977
	BL	8.77	0.53	8.64	0.45	
Upper second molar	MD	8.57	0.69	8.66	0.54	1.2629
	BL	9.71	0.46	9.70	0.46	

SD: Standard deviation

**Table 2: Mean sizes of deciduous lower molars among different groups**

Tooth	Dimension	Group I 50 males		Group II 50 females		P
		X	SD	X	SD	
Lower first molar	MD	7.49	0.43	7.37	0.51	1.0691
	BL	7.78	0.56	7.46	0.61	
Lower second molar	MD	9.52	0.53	9.27	0.62	1.3057
	BL	9.11	0.55	8.78	0.41	

SD: Standard deviation

further 100 children were selected based on the inclusion criteria which were further divided into two groups. The findings of our study showed that the mesiodistal dimension of mandibular teeth is larger in comparison to maxillary counterparts. Similar is the case with buccolingual dimensions of maxillary teeth in comparison to their mandibular counterparts. These results are in accordance with the various studies done in the past.<sup>[7,11-17]</sup>

The present study showed that the males had slightly larger molar dimensions as compared to females; however, the results were statistically insignificant. Similar results were concluded by Yuen *et al.*,<sup>[18]</sup> in Chinese population and Barberia *et al.*,<sup>[12]</sup> in Spanish White children. However, Margetts and Brown<sup>[7]</sup> found a significant dimorphism in mandibular primary molars which is in contradiction with the results of our study.

According to the results of the present study, the maxillary and mandibular primary first molar measurements were more stable when compared to second primary molar measurements which are in accordance with the studies done in various other populations of Spanish, Australian, and Brazilian origin.<sup>[12,16,19]</sup>

The limitation of our study is that antimeric (right and left) teeth comparison has not been considered. Furthermore, the sample size was limited and various ethnicity of Jammu and Kashmir population could have been considered for more appropriate measurements.

## CONCLUSION

It can be concluded that the dimensions of primary molars are slightly larger in males in comparison to females. The data about these measurements have an anthropological significance to differentiate various genders in different

populations and may help to understand the development of occlusal system and associated malocclusions.

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# Role of a Dental Surgeon in Management of Oral Cancer Patients: A Review Article

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## Abstract

In the 21<sup>st</sup> century, oral cancer is rapidly becoming a global health priority. Head and neck cancer ranks among the top three cancers in India and its treatment involves radiotherapy, which has various dental complications. Such patients can appear with radiation caries, trismus, xerostomia, osteonecrosis, and other dental changes within the first 3 months following radiotherapy. Due to this increasing rate of patients being treated for cancer, a general dentist should be well-informed of the various oral problems, its management and their role to lessen these side effects through the way treatment is rendered. Every effort should be focused on prevention of severe dental caries preoperatively since restorative treatment of radiation caries becomes an exigent task later. Counseling of patients before and after radiotherapy can help to alert them about its complications, its prevention, and management.

**Key words:** Cancer, Dental caries, Oral care on cancer patients, Radiotherapy complications

## INTRODUCTION

Oral cancer is of significant public health importance to India as it ranks among the top three cancer in the country.<sup>[1]</sup> About 12% of mortality rate worldwide is due to cancer, and in about 20 years, it is anticipated to increase from about 6 to 10 million.<sup>[2]</sup> The major cause of this global health issue is the rising number of tobacco and alcohol users in children and youth.<sup>[3]</sup> The other risk factors of oral cancer are human papillomavirus infections, sharp or ill-fitting dentures, lack of proper diet, weak immune system, hereditary, and exposure to sun's UV rays.<sup>[4]</sup>

As per data of Global Adult Tobacco Survey 2010, Uttar Pradesh tops in early deaths due to tobacco followed by Bihar and Maharashtra.<sup>[5]</sup> A study reported that the ratio of male:female for oral cancer was 2:1. 6.25% were young

(<30 years), 67.24% were in 30–60 years, and 26.51% were more than 60 years. The most common cancers among the youngest age group were those of tongue and buccal mucosa (41.26%). 75% oral cancer patients had risk habits, 55% were habituated for >10 years, and 25% were habit free. Majority 59% were chewers of betel quid alone (17%)/betel quid with tobacco (42%); smokers were (31%) and alcohol users were (14%) of patients. Chewers of Gutkha, Khaini were more in 30 years.<sup>[6]</sup>

In view of the fact that the treatment of oral cancer has potential side effects in oral tissues, the quality of life of such patients is compromised due to chemotherapy and radiotherapy. Hence, a proper role of a dentist in managing a cancer patient before, during and after cancer treatment can benefit the patient beyond oral cavity.<sup>[7]</sup>

## SCREENING OF ORAL CANCER

The most common symptom while screening of oral cancer is a sore in the mouth that does not heal and constant pain in oral cavity. A patient may turn up with a lump or thickening in the cheek, a white or red patch on the gums, tongue, tonsil, or lining of the mouth or a sore throat. The patient may complain of difficulty in chewing or swallowing, trouble in

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moving the jaw or tongue, numbness of the tongue or other area of the mouth, change in voice, constant bad breath, ill-fitting denture, mobile teeth, or a lump or mass in the neck.<sup>[8]</sup>

## ORAL COMPLICATIONS RELATED TO CANCER TREATMENT

Oral mucositis and xerostomia is a general complication related to both chemotherapy and radiotherapy, it increases the risk for pain, oral or systemic infections, radiation caries, nutritional compromise, impaired ability to eat, taste, swallow, and speak. Children exposed to radiotherapy and/or high doses of chemotherapy before the age of 9 years may have abnormal tooth development, craniofacial growth, or skeletal development. Certain classes of drugs, such as the Vinca alkaloids cause neurotoxicity, i.e., persistent, deep aching, and burning pain that mimics a toothache, with no established dental or mucosal source. The effects of chemotherapy on bone marrow decrease the platelets and clotting factors which may result in bleeding from soft tissues in oral cavity. There is lifelong risk of rampant dental decay that may begin within 3 months of completing radiation treatment if changes in either the quality or quantity of saliva persist. Trismus or tissue fibrosis may occur due to loss of elasticity of masticatory muscles. Osteonecrosis may occur due to exposure to high-dose of radiation therapy.<sup>[9]</sup>

## THE SIGNIFICANCE OF PRE-TREATMENT ORAL CARE

A thorough oral evaluation by a knowledgeable dentist before cancer treatment begins is crucial to the success of the regimen. It reduces the risk and severity of oral

complications, allows for prompt identification and treatment of existing infections or other problems, improves the likelihood that the patient will successfully complete planned cancer treatment, prevents, eliminates, or reduces oral pain, preserves or improves oral health, decreases the cost of care, and provides an opportunity for patient education about oral hygiene during cancer therapy, thus improving the quality of life of the patient.<sup>[9]</sup>

## HOW CAN A DENTIST BE HELPFUL?

Before cancer treatment begins a dentist should treat all the existing infections, caries and tissue injury or trauma. After a complete mouth oral prophylaxis, topical application of fluoride varnish at an interval of 3 months should be done to prevent radiation caries. The teeth in the radiation field which cannot be saved and mobile deciduous teeth in case of children should be extracted. If a patient wears removable prosthesis, it should be clean and well adapted to the tissue. Orthodontic bands and brackets should be removed if highly stomatotoxic chemotherapy is planned or if the appliances will be in the radiation field. To minimize oral complications, the patient should be educated.<sup>[9]</sup>

In addition to this, the dentist should register and document the tobacco use profile in detail of the patient and his/her relatives. Effective tobacco cessation counseling can be done by group counseling/individual counseling/relatives counseling. Carbon monoxide monitoring should be done. Pharmacotherapy can be helpful in cases where patients are unable to quit with voluntary control. Regular follow-up with brief counseling at each visit is necessary for encouragement. Educational materials should be displayed and quitters should be rewarded [Table 1].<sup>[10]</sup>

**Table 1: Oral care guidelines for patients<sup>[11]</sup>**

Brushing	Flossing	Mouth rinse	Others
Brush teeth, gums, and tongue gently with an extra soft toothbrush and fluoride toothpaste after every meal and before bed	Floss teeth gently every day	Avoid mouthwashes containing alcohol. It burns the tissue	Exercise the jaw muscles 3 times a day to prevent and treat jaw stiffness from radiation. Open and close the mouth as far as possible without causing pain; repeat 20 times
Use of soft bristles toothbrush after rinsing it in warm water to avoid tissue damage	If gums are sore or bleeding, avoid those areas till it heals but keep flossing other teeth	Rinse the mouth with a baking soda and salt solution, followed by a plain water rinse several times a day. It helps tissue to heal. (Use ¼ teaspoon each of baking soda and salt in 1 quart of warm water.) Omit salt during mucositis	Avoid candy, gum, and soda unless they are sugar-free
Use mild toothpaste, avoid use of whitening agents		Use chlorhexidine mouthwash to prevent infections	Avoid spicy or acidic foods, toothpicks, tobacco products, and alcohol
Replace toothbrush in every 3 months or after any infection			Avoid ill-fitting dentures; it increases the risk of osteonecrosis of jaw Keep the appointment schedule recommended by the dentist

**Key Notes<sup>[9]</sup>**

- High-dose radiation treatment carries a lifelong risk of xerostomia, dental caries, and osteonecrosis.
- Due to the risk of osteonecrosis, principally in the mandible, patients should avoid invasive surgical procedures, including extractions that involve irradiated bone. If an invasive procedure is required, use of antibiotics and hyperbaric oxygen therapy before and after surgery should be considered.
- Lifelong daily fluoride application, good nutrition, and conscientious oral hygiene are especially important for patients with salivary gland dysfunction.
- Dentures may need to be reconstructed if treatment altered oral tissues. Some people can never wear dentures again because of friable tissues and xerostomia.
- Dentists should closely monitor children who have received radiation to craniofacial and dental structures for abnormal growth and development.
- Dentists should be mindful about the recurrence of malignancies in patients with oral and head and neck cancers, and thoroughly examine all oral mucosal tissues at recall appointments.

**CONCLUSION**

Preventive measures before radiation therapy can reduce the risk of postradiation complications, improving the quality of life of the patient postoperatively. Hence, as

dental professionals, it is our responsibility to educate these patients, how to deal with oral side effects of radiotherapy and provide them essential dental care preoperatively and postoperatively.

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# A Case Study on Repair and Reduction of Infraorbital Rim Fracture

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## Abstract

Orbital fracture forms a major portion of the facial trauma cases, caused due to road traffic accidents. These fractures can be managed by multidisciplinary team consisting of faciomaxillary surgeons, plastic surgeons, general surgeons, and ophthalmologists. The management of these fractures can be done under general anesthesia as well as local anesthesia. There are many advantages which can be taken into consideration when the repair procedure is done under regional or local anesthesia. Here, presenting a short case of orbital rim fracture management in dental chair under local anesthesia.

**Key words:** Fracture repair, Local anesthesia, Orbital rim fracture

## INTRODUCTION

Facial trauma constitutes a major portion of general traumatic cases. 30–40% of the cases of facial trauma involves orbit.<sup>[1]</sup> Zygomatic bone, maxillary bone, and palatine bones which make the floor of the orbit, fracture of this infraorbital rim can majorly affect the infraorbital nerves and blood vessels as it involves the infraorbital groove.<sup>[2]</sup> Various approaches are used for the repair with the help of transcutaneous and transconjunctival approach. Orbital fractures can be managed by multidisciplinary team consisting of ophthalmologists, faciomaxillary surgeon, and plastic surgeons. Introduction of newer materials such as porous polyethylene and titanium have improvised the treatment outcome.<sup>[3,4]</sup> The preliminary goal of the orbital fractures remains to reposition the herniated fat of orbit and restore the bone contours.

## CASE REPORT

The patient came to the outpatient department after accident with swelling of the right periorbital region [Figure 1]. Informed consent has been obtained from the patient to use the photographs for record and data sharing purpose. The diagnostic radiograph was obtained. The main aim was to perform reduction and repair of infraorbital rim to maintain anatomy of fractured region from esthetic and functional point of view by rigid fixation and to avoid the parasthesia of infraorbital nerve on dental chair (backrest position was 15° angulated to the base of dental chair) under sterilization and asepsis after local anesthesia (infraorbital nerve block and infiltration of related area) with xylocaine with adrenaline (1:80000) infraorbital incision was done on the scar due to previous trauma. After blunt dissection of orbicularis muscle and after elevation of periosteum, the fractured part of infraorbital rim was clearly exposed and the operative field was extended for rigid fixation. Rigid fixation was done by six holes titanium mini orbital plate with 2 mm (four) titanium screw maintaining the law of fixation [Figure 2] and radiograph was obtained [Figure 3]. Periosteum and inner muscle layers were closed with 3–0 vicryl and superficial skin sutured by 4–0 proline. Healing was satisfactory with reduced pain after 1 week postsurgery [Figure 4] and 2 weeks [Figure 5].

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Figure 1: Presurgical image



Figure 4: Repair of the fracture of infraorbital rim

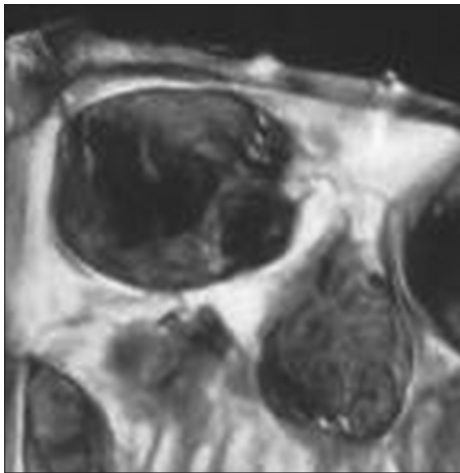


Figure 2: Pre surgical radiograph (Diagnostic)



Figure 5: Healing after 1 week of postsurgery



Figure 3: Surgical approach



Figure 6: Healing after 2 week of postsurgery

## DISCUSSION

Esthetic disfigurement is one of the important concerns with any road traffic accidents (RTA) and RTA is one of the leading causes for facial trauma. Faciomaxillary surgeons are in constant attempts to improve eyes and best attempts to maintain both esthetics and function. Orbital rim fractures

are usually managed by exposing the lower orbital rim by various types of incisions such as subciliary infraorbital and transconjunctival. There are various complications after the treatment including scarring, ectropion, epiphora, and pigmentation. Conjunctival incisions avoid external scar

compared to skin muscle flap incisions.<sup>[5,6]</sup> Although there were options of subciliary and transconjunctival incisions which were preferred due to esthetic point of views. However, in this case, already the previous scar was there on infraorbital rim due to trauma. Hence, we preferred here infraorbital incision due to the previous scar on incision site and ease of surgery along with more exposed area of operative field. Periorbital edema with ecchymosis, parasthesia on the area supplied by lower palpebral, lateral nasal, and superior labial due to compression of nerve due to fracture were found in this case. Mainly to avoid permanent nerve damage, the fracture of infraorbital rim was repaired and the step on infraorbital rim was also corrected. In post-operative follow-up, the improvement of the patient was very significant, and the areas supplied by lower palpebral, lateral nasal and superior labial on that particular site was normal after 2 weeks that means no neuropraxia on that particular region was found. There are few cases reported to be managed under regional anesthesia and their results are compatible to the cases done under general anesthesia. The patient under regional anesthesia along with the light medication feels relaxed and comfortable during the entire procedure.<sup>[7]</sup> In nerve block always remains better than general anesthesia, due to the low-stress induction and less incidence of complication, there are reports of orbital rim fracture management with local anesthesia, but are few.<sup>[8]</sup>

## CONCLUSION

If the immediate step was not taken then permanent damage of aforesaid nerves, permanent damage of

those nerve could be occurred. There was no case study till revealed the infraorbital rim fracture repaired done under local anesthesia on dental chair. To save patient from neuropraxia of those particular nerve, the immediate step was taken on dental chair under local anesthesia.

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# Successful Outcome of a Post-dated Pregnancy in a Patient with Uncorrected Tetralogy of Fallot with Pulmonary Atresia

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## Abstract

Tetralogy of Fallot (TOF) is the most common form of cyanotic congenital heart disease, with an overall incidence of around 10% of all congenital heart diseases. TOF with pulmonary atresia is at the extreme end of the anatomic spectrum which is difficult to correct surgically. We have discussed here a rare case of a post-dated pregnancy with uncorrected TOF with pulmonary atresia and its successful pregnancy outcome in a 24-year-old woman at a tertiary care centre with a multidisciplinary approach.

**Key words:** Congenital heart disease, Pulmonary atresia, Tetralogy of fallot

## INTRODUCTION

Tetralogy of Fallot (TOF) is characterized by pulmonary stenosis, right ventricular hypertrophy, overriding aorta, and non-restrictive ventricular septal defect (VSD). TOF is the most common form of cyanotic congenital heart disease occurring in approximately 1 in 3600 live births. It accounts for 3.5% of all infants born with congenital heart diseases. To reach adulthood, most patients end up requiring correctional surgery for TOF. Only few patients survive up to adulthood without correction of TOF.<sup>[1,2]</sup> Survival into the fourth decade without surgery is extremely rare (only about 3%).<sup>[3]</sup> The principle danger for a pregnant woman with TOF is cardiac decompensation due to inability to meet the additional demands imposed by the physiological changes of pregnancy and parturition. Maternal complications in these women include worsening cyanosis and dyspnea, right ventricular failure, thromboembolism, pulmonary hypertension, arrhythmias, and maternal mortality. Fetal complications include abortions, intrauterine growth restriction, prematurity, and intrauterine demise. Obstetrical

events include spontaneous abortions, premature rupture of membranes, and preeclampsia. The risks of maternal cardiac complications depend on the severity of residual lesions at the time of conception. Maternal death is rare. Pregnancy is generally well tolerated with no long-term sequelae.

Patients with TOF often present with cyanosis in the 1<sup>st</sup> year of life. Survival of these patients largely depends on the degree of pulmonary obstruction and the pulmonary blood supply. Limitation of blood to the lungs combined with VSD results in supply of oxygen-poor blood to the body, causing cyanosis. Pink TOF is characterized by mild pulmonary stenosis, and the VSD is in balance resulting in no significant right to left shunt. The degree of right ventricular outflow is minimal and no cyanosis develops in these patients. These patients have mild symptoms and diagnosis may be delayed, and these patients are often asymptomatic up to adulthood.

Heart diseases complicate 0.2–3% of pregnancies and congenital heart lesions now constitute at least half of all these cases. TOF with pregnancy is even rarer. The incidence of TOF with pulmonary atresia is 0.007/1000 live births and accounts for one-fifth of all cases of TOF.<sup>[4]</sup> Uncorrected TOF with pulmonary atresia in pregnancy is a rare entity with limited literature. Pregnancy in uncorrected TOF entails serious risks including increased maternal morbidity and mortality up to 15% and poor perinatal

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outcome.<sup>[5]</sup> Most women with repaired TOF can have successful pregnancies. In agreement with the WHO classification, the repaired TOF is ranked in Class II category and the cyanotic unrepaired heart diseases in Class III category.

## CASE REPORT

A 24-year-old Primigravida residing from Golaghat, Assam, was referred from Jorhat Medical College and Hospital. She was referred as a case of Primigravida at term pregnancy not in labor with subaortic VSD with bidirectional shunt and valvular pulmonary stenosis. The patient had presented to Jorhat Medical College with occasional complaint of cough and easy fatigability, and she was classified as NYHA Class II. The patient had an uneventful childhood. During the third trimester (8<sup>th</sup> month), she had occasional cough, easy fatigability, and shortness of breath which was not relieved on over the counter drugs for which she consulted her obstetrician. On investigation, a cardiac lesion was detected which on further investigation was found to be acyanotic TOF. She was hence referred to Assam Medical College and Hospital for further management on July 22, 2017 and was admitted in labor room the same day.

On general examination, she was fully conscious and oriented with a pulse rate of 92/min regular and normovolemic, blood pressure of 102/82 mmHg, respiratory rate of 22/min, afebrile on touch, no evidence of central cyanosis, clubbing, or peripheral edema. On cardiovascular and respiratory examination, she had normal vesicular breath sounds and bilaterally symmetric chest movements. S1 was normal and S2 was single and loud with a pansystolic murmur. Obstetric per abdominal examination showed a term sized uterus, longitudinal lie, cephalic presentation, fetal heart sounds localized on the right spinoumbilical line which was 144/min in rate and regular in nature. The patient was shifted to antenatal ward and was investigated further. Investigations showed hemoglobin of 12.0 g%, white blood cell 7200/cc, and platelet count 1.9 lakh/cc. The hematocrit was mildly raised (49%). O<sub>2</sub> saturation at room air was 97%. Coagulation profile, blood chemistry, urine analysis, and serum electrolytes were within normal limit. Ultrasonography revealed a single live fetus in cephalic presentation with a gestational age of 35 weeks and 5 days, BPP of 8/8 and estimated fetal weight of 2768 g. No gross fetal congenital anomaly was noted. Doppler was normal.

Electrocardiogram showed sinus rhythm with right axis deviation and right ventricular hypertrophy. Echocardiogram (ECHO) showed situs solitus with AV and VA concordance with normal biventricular function, non-restrictive sub-

aortic VSD with bidirectional shunt with overriding aorta, right ventricular hypertrophy with mild pulmonary stenosis, and small pulmonary atresia. No evidence of any vegetation or effusion. No coarctation of the aorta and no collaterals were seen from descending aorta. Ejection fraction was 67%. Cardiologists advised infective endocarditis prophylaxis before delivery of ceftriaxone 2 g and gentamycin 120 mg, and the patient was considered as moderate risk for delivery. The patient and party were counseled about the situation of patient and induction was considered. PGE2 gel was instilled intracervically on July 28, 2017 in morning. Strict maternal and fetal monitoring continued. The patient delivered a healthy 2.830 kg male baby in morning of July 29, 2017 by outlet forceps application. Active management of 3<sup>rd</sup> stage of labor was done. Post-delivery immediately 40 mg furosemide was administered intravenously, uterotonics were used and fluids were restricted. After delivery, her general condition was fair along with pulse rate of 92/min, regular and BP was 104/82 mm of Hg. Oxygen inhalation was continued throughout delivery and after delivery as well. Post-delivery vital monitoring of patient continued. Uterus was well contracted. No post-delivery complication was noted. The patient was shifted to cardiac intensive care unit the same day for intensive monitoring. The patient was stable and shifted back to obstetric HDU on July 31, 2017. The patient was discharged on August 1, 2017 (4<sup>th</sup> postnatal day). Fetal ECHO was advised to be done for the baby. Risks of next pregnancy were well explained to the patient and her husband, and the husband was advised to use barrier method for contraception. The patient came for follow-up 12-week postpartum and reviewed in cardiology department as well. Both the mother and the baby enjoyed good health. Regular follow-up was advised from cardiology point of view. Fetal ECHO was not done by the patient and was again reminded to do so. A surgical correction was offered for the same [Figures 1 and 2].

## DISCUSSION

Uncorrected TOF in adulthood is rare and TOF with pregnancy is even rarer. Although survival into adulthood without correction is rarely reported, the development of congenital systemic-pulmonary collaterals may enable patients with pulmonary atresia to reach adult age as in our patient. It is classified as moderate risk for pregnancy with heart disease with mortality rate reaches 5–15%. Management of these patients in pregnancy is challenging due to associated hemodynamic alterations. To reduce these problems, sufficient rest and oxygen therapy have been suggested. Careful postpartum monitoring is essential in these patients as sudden cardiovascular alterations in the postpartum period may be detrimental in these patients.





**Figure 1: The patient with pink tetralogy of Fallot at 12-week follow-up**



**Figure 2: The infant born to mother with pink tetralogy of Fallot at 12-week follow-up**

Active management of 3<sup>rd</sup> stage of labor and prevention of postpartum hemorrhage is mandatory as even lesser blood loss can lead to decompensation in these women.

During pregnancy, the additional observations needed include blood gas analysis (especially pO<sub>2</sub> and saturation of O<sub>2</sub>) and hematocrit/hemoglobin. Fetal growth and well-being need to be monitored carefully. Vaginal birth is the preferred mode of delivery in women with TOF as in our patient. Cesarean section is indicated only for obstetrical indications. Infective endocarditis prophylaxis is recommended, which was given in our patient.

Genetic counseling and transmission of congenital heart disease to offspring should be discussed. The risk of transmission of congenital heart disease is approximately 5–50%, compared to a background risk of 1% of having a baby with congenital heart disease. Incidence of cardiac defects in infants of TOF patients ranges from 3 to 17%.<sup>[6]</sup> The risk of transmission is dependent on associated genetic syndrome. A discussion about contraceptive methods is appropriate in all women with repaired or unrepaired TOF. Combined hormonal contraceptives are contraindicated in women with unrepaired TOF. Regular follow-up should be done from cardiology point of view.

A multidisciplinary teamwork is essential for the management of patients with uncorrected TOF and pregnancy. Without optimum intensive obstetrical and medical management, prognosis of these patients remains poor with high morbidity and mortality rates.

## CONCLUSION

Pregnancy in patients with uncorrected TOF is a life-threatening condition for both mother and fetus. Various maternal, fetal, and obstetrical complications are associated in pregnant patients with uncorrected TOF. A multidisciplinary approach is required for the management of patients with uncorrected TOF and pregnancy.

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