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Current Profile of Hepatitis C in Tripura, India

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Abstract

Introduction: Viral hepatitis is one of the common causes of chronic liver disease. Hepatitis C is the second most important cause of chronic viral hepatitis. Globally, an estimated 71 million people have chronic hepatitis C infection. In 2015, there were 1.75 million new hepatitis C virus (HCV) infections. Approximately 399,000 people die each year due to HCV-related cirrhosis and hepatocellular carcinoma. Highest numbers of infections are noted in Egypt. South East Asian region countries are also having high prevalence. The prevalence in India is around 1%. In Tripura, blood bank-based study shows prevalence around 0.1%. Higher prevalence was seen in patient on maintenance hemodialysis.

Objectives: The study was designed to determine. (1) Mode of transmission of hepatitis C in Tripura, (2) To evaluate genotypic pattern of hepatitis C infection in Tripura, (3) To evaluate coinfection with human immune deficiency virus (HIV)/hepatitis B virus (HBV).

Materials and Methods: It was a cross-sectional study done on 60 consecutive hepatitis C patients attended the liver clinic of Hepatitis Foundation of Tripura between January 2018 and December 2018.

Results: The study reveals that in this group, 65% hepatitis C patients were males and 35% were females and 63.3% patients are from rural areas whereas 36.7% patients are from urban areas. Study shows that there is shift of age among hepatitis C patients from older to the younger group. It was observed that 5% of hepatitis C patients had coinfection with HIV infection but no coinfection with HBV. Regarding mode transmission of hepatitis C, 30% are through blood transmission, 20% through drug abuse, 16.7% patients through sexual route, 11.6% patients through dialysis, 1.7% prenatal transmission, and 20% remain unknown. Genotype 3 was 75% (3a was found in 55% and 20% were genotype 3b,) and genotype 1 was 25% (21.7% genotype 1a and 3.3% were genotype 1b). In the study group, 18% were in decompensated chronic liver disease.

Discussion: The prevalence of HCV infection seems to be increasing among people who inject drugs in Tripura. Male preponderance in this study may be due to more exposure to drugs among males. Higher prevalence of Hepatitis C among the rural people may be due to increase quackery practice in the rural areas.

Key words: Hepatitis B virus, Hepatitis C virus infection, Hepatocellular carcinoma, Human immune deficiency virus, Maintenance hemodialysis, People who inject drugs

INTRODUCTION

The liver was considered as “seat of soul” in Greek mythology. Roman anatomist “Galen” first considered the liver as the principal organ of human body. Understanding of liver diseases has undergone extensive changes, and today, we know that “hepatitis viruses” are the most common cause of liver disease. Major hepatotropic

viruses are of six types, hepatitis A, B, C, D, E, and G. Hepatitis A and E are transmitted by the fecal–oral route, while others are blood borne. Hepatitis C was discovered by Houghton in 1989.^[1] No vaccination for hepatitis C has been discovered till date. However, advancement in treatment modality of hepatitis C has been magnificent, from interferon-based therapy, to direct-acting antiviral agents leading to cure of disease.

Hepatitis C virus (HCV) accounts for approximately 15–20% cases of acute hepatitis.^[2] After acute infection, around 70–85% of HCV patients will develop chronic infection.^[3] Globally, an estimated 71 million people have chronic hepatitis C infection. In 2015, there were 1.75 million new HCV infections.^[4] Approximately 399,000 people die each year due to HCV-related cirrhosis

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and HCC.^[5] Highest numbers of infections are noted in Egypt.^[6] South East Asian region countries are also having high prevalence. The prevalence in India is around 1%.^[7] In Tripura, blood bank-based study shows the prevalence around 0.1%. Higher prevalence was seen in patient on maintenance hemodialysis.^[8]

The prevalence of anti-HCV in the general population in India is approximately 1%, of which 80% have detectable HCV RNA.^[9] Transmission is by parental routes.

Hepatitis C is a RNA virus comprising six genotypes. Genotype 3 is the most common type in India, followed by genotype 1. Overall, genotypes 1, 2, and 3 are most common in North America and Europe, while genotype 4 is most common in Middle East and Africa. Genotype 5 is seen mostly in South Africa and South East Asia and genotype 6 is mostly seen in South-East Asia.^[10]

Incubation period of HCV ranges from 15 days to 160 days with a mean of about 50 days. Acute illness is usually asymptomatic and clinically in-apparent. Non-specific symptoms such as nausea and fatigue can be seen in 20–30% cases. Patients with symptomatic acute infection and jaundice have higher chances of spontaneous clearance. Spontaneous loss of HCV RNA from blood occurs with 3 months–4 months in these patients. Progression to chronicity occurs in 70–80%. Approximately 20–30% of those patients will develop cirrhosis over 20–30 years. Once cirrhosis develops, decompensation occurs at the rate of 3% per year. In HCV-associated liver cirrhosis, hepatocellular carcinoma occurs in 4–5% of patients per year.^[11]

This study was designed to evaluate the pattern of HCV infection in Tripura.

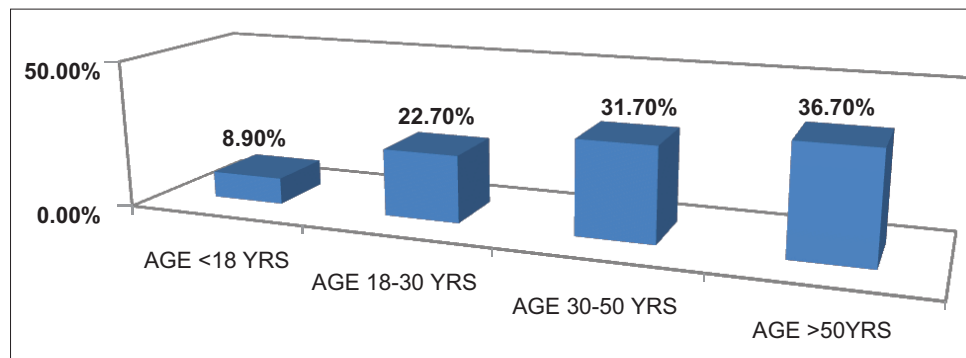


Figure 1: Age-wise distribution of hepatitis C

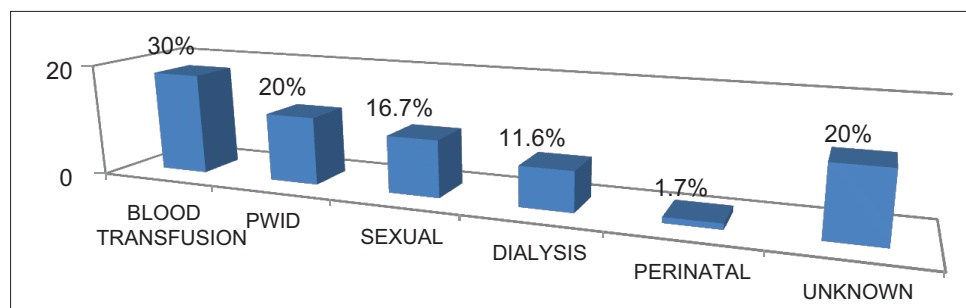


Figure 2: Mode of transmission of hepatitis C

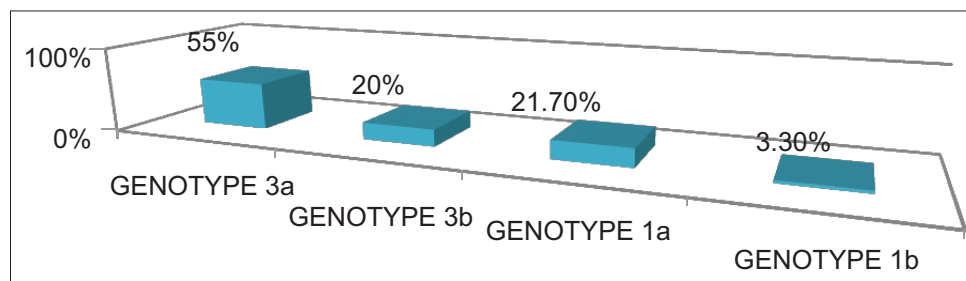


Figure 3: Genotype-wise distribution of hepatitis C in Tripura

Objectives

1. Mode of transmission of hepatitis C in Tripura
2. To evaluate genotypic pattern of hepatitis C infection in Tripura
3. To evaluate coinfection with human immune deficiency virus (HIV)/hepatitis B virus (HBV).

MATERIALS AND METHODS

This is a cross-sectional study done on 60 consecutive hepatitis C patients attended the liver clinic of Hepatitis Foundation of Tripura between January 2018 and December 2018. Male preponderance is found in hepatitis C infection.

Liver clinic is one of the premier centers of management of liver disease in Tripura, and most of the hepatitis C patients get treatment from this center. Hence, epidemiological evaluation of these patients represents the hepatitis C disease scenario of Tripura. Accordingly, the study was designed, and data were collected in a pre-designed pro forma. The evaluation includes a history of the patients, particularly mode of transmission of hepatitis C. All patients were clinically evaluated for status of disease particularly decompensation. HCV RNA was evaluated for quantitative status and genotypes. The recorded data has been evaluated statistically.

RESULTS

The study was done among the first 60 consecutive patients of hepatitis C received at liver clinic of hepatitis foundation of Tripura.

The study reveals that among the patients who received treatment at liver clinic, 65% of them were male and 35% were female. Similarly, on analysis of rural and urban ratio, there was a rural preponderance (63.3%) which is significant.

The age distribution was analyzed in the study group, and it was observed that 8.9% of the patients were below 18 years of age and 22.7% of the patients were at the age group of 18–30 years. Although 36.7% of the patients were above the 60 years of age, 31.7% of patients were between 30 and 50 years of age. It shows that there is a shift of age among hepatitis C patients of the study group from older to the younger age group [Figure 1].

The mode of transmission of hepatitis C was analyzed on the basis of history from the patients and relatives, and it was found that blood transfusion (30%) is probably the most common cause of hepatitis C transmission [Figure 2].

The most astonishing observation was that 20% of the hepatitis C is directly related to the injectable drug abuse people who inject drugs (PWID).

Through in 20% of the patient, the extract mode of transmission could not be determined, but hemodialysis is still probably the cause of hepatitis C among 11.6% of the patients of the study group.

The genotype of hepatitis C was analyzed in all patients, and it was observed that genotype C (75%) is the most common genotype in Tripura. Out of these, genotype 3A was 73% and genotype 3B was 27%. Rests of the hepatitis C patients were genotype 1 (25%). Out of these, 88% were genotype 1A and 12% were genotype 1B [Figure 3].

Coinfection was studied among all the patients of hepatitis C, and it was found that 5% of the hepatitis C patients were also having HIV coinfection, but there was no HCV and HBV coinfection in the study group.

The status of disease was evaluated, and it was found that 18% patients were in a state of decompensation requiring immediate attention.

DISCUSSION

HCV infection is one of the major global health burdens and its prevalence varies regionally depending on its historical and present risk factors. This study of Tripura represents a comprehensive effort to present in a systematic manner the actual situation of the epidemiology of HCV infection in this Northeast state of India. Studies on HCV prevalence among blood donors, hemodialysis patients were done previously. Study reveals that 10.9% patients were newly infected with hepatitis C during dialysis.^[8] The average of HCV positivity in 8 years period was 0.109% among the blood donors. HCV seropositivity among voluntary and replacement donors was 0.109%, and 0.11%, respectively.^[9]

Injecting drug use is the primary risk factor for hepatitis C, accounting for approximately 70% of new infections in 2016 in the United States.^[11] Globally, there are an estimated 14 million PWID (range: 11.2–22.0 million) who are at risk of HCV infection.^[10] Previously, HCV infection had affected PWID aged ≥ 40 years. However, recent HCV infection outbreaks among networks of PWID have demonstrated a changing demographic pattern of HCV-infection among young PWID (18–35 years), and predominantly males are affected in comparison to females.^[12] The present study also reveals a male preponderance of hepatitis C infection and more common in younger age.

In this study, blood transmission was the cause of hepatitis C transmission among 30% of the patients, whereas in 20% patients, it was through injecting drugs (PWID). This shift of mode of transmission had been observed in some recent

studies. The WHO updates in 2018 revealed that 60% of patients had mode of transmission through PWID, 10% patients through blood transmission, 15% patients through sexual route, hemodialysis, and prenatal, other is 5% cases, and 10% remain unknown.^[13] In the present study, almost all PWIDs with HCV infection are below the age of 25 years, and there is significant male preponderance. This may be due to the higher prevalence of PWID among male in Tripura. But Abara *et al.* have demonstrated significant female preponderance in the USA.^[12] This may be due to the higher prevalence of PWID among male in Tripura.

In Tripura, it was observed that only 5% of HCV patient are having HIV coinfection, whereas the same group (Abara *et al.*) has demonstrated a 52.4% HIV/HCV coinfection.^[12] This may be due to the comparatively less prevalence of HIV infection and coinfection in Tripura.^[14,15]

In this study, there was clear rural preponderance which may be due to quackery practice prevailing in the rural community or more addiction to drugs of rural boys residing in city for study purpose. This needs in depth analysis.

The present study reveals higher prevalence of genotype 3 (75%) among the study group. Barman *et al.* in 2018 from North East India have reported a 48.5% prevalence of genotype 3,^[16] whereas Chakravarti *et al.* have reported genotype 3 prevalence of 63%.^[17] It shows that genotype 3 is more common in Tripura and only 25% are genotype 1 and there is no other genotype.

CONCLUSION

The present study confirms the global trends of paradigm shift of mode of transmission of hepatitis C. At the time of discovery in 1989, hepatitis C was mainly due to blood transfusion but gradually other mode of transmission like hemodialysis and hospital-borne infection came out as important cause. However, PWID is one of the important modes of transmission of hepatitis C at present throughout the world. It has also shifted to younger age group leading to higher risk of HCV-related chronic liver disease in the future.

The genotypic distribution of HCV needs mapping in details and will provide an in depth knowledge of drug and disease migration in coming years.

The present study reveals that PWID is also becoming an important mode of transmission of hepatitis C in Tripura

and probably adjoining Bangladesh and other states of India.

This needs immediate intervention at community and society level. Scientific community needs to act in conjugation with social activist to reduce the burden of hepatitis C.

As at present no hepatitis C vaccine is available, an extensive global approach to prevent hepatitis C transmission is of paramount importance.

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Correlation between Ultrasound Features and Histopathological Findings in Adnexal Masses – A Study in a Tertiary Care Center in Central India

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Abstract

Background: Ovarian cancer has emerged as one of the most common malignancies affecting women in India. A multidisciplinary approach is needed for the optimal management of patients presenting with adnexal mass wherein the radiologist and the pathologist play an important role in assisting in clinical decision-making. The present study is done to correlate the ultrasound findings with the histopathological findings and to study the whole spectrum of adnexal masses.

Methods: This is a prospective observational study carried out on 60 patients with adnexal masses and pre-operative ultrasound assessment and who underwent surgical resection of their masses in a tertiary care center.

Results: The pre-menopausal age group was more frequently affected than post-menopausal age group. A large number of adnexal masses were of ovarian origin. The incidence of neoplastic adnexal masses is much higher than the non-neoplastic masses. Among the neoplastic adnexal masses majority were ovarian tumors. The incidence of benign ovarian tumors is higher than malignant tumors. Among the malignant tumors, serous cystadenocarcinoma was the most common tumor. Majority of the ovarian tumors diagnosed by ultrasonography (USG) as purely cystic in architecture were proven benign tumors on histopathology. Of the solid-cystic tumors, 50% were benign, and 50% malignant on histopathology solid architecture of the tumors was the least common, and the majority were malignant. USG diagnosis of adnexal masses revealed a sensitivity of 94.4%, specificity of 83.3%, positive predictive value of 70.8%, and negative predictive value of 97.2%.

Conclusions: USG is a sensitive and specific modality in pre-operative diagnosis of the malignant nature of lesions. The presence of solid component in an ovarian mass was a highly accurate predictor of malignancy.

Key words: Adnexal masses, Histopathology, Ovarian tumors, Ultrasound

INTRODUCTION

The adnexal mass may be benign or malignant, but most of these are benign. Most common adnexal mass is of ovarian origin and presents with a diverse range from the functional ovarian cyst to benign tumors or malignant tumors of the

ovary. The most critical step after identification of the mass is the determination of the degree of suspicion for malignancy, which has a profound effect on patient survival.

Patients are subjected to thorough clinical examination, transvaginal, or transabdominal ultrasonography (USG) and measurement of CA-125, also called the three-pronged evaluation. The role of a gynecologist and radiologist is of paramount importance in the initial assessment of the patient. A revolutionary change has occurred in the pre-operative detection of adnexal masses with the use of grayscale transvaginal and transabdominal USG. It has emerged as a sensitive modality in the diagnosis of malignant masses. The main reason to discriminate

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preoperatively between benign and malignant mass is to promote more conservative management for benign disease and optimize referrals to gynecologic oncologists in cases of suspected ovarian malignancies. A multidisciplinary approach is needed for the optimal management of patients presenting with adnexal mass wherein the radiologist and the pathologist play an important role in assisting in clinical decision-making.

Of all the adnexal masses, ovarian tumors alone account for nearly two-third of all the cases. Ovarian cancer has emerged as one of the most common malignancies affecting women in India. The age-specific incidence rate for ovarian cancer revealed that the disease increases from 35 years of age and reaches a peak between the ages of 55 and 64 years. In India, during the period 2004–2005, the proportion of ovarian cancer varied from 1.7% to 8.7% of all female cancers in various urban and rural population.^[1]

The present study is done to correlate the radiological findings with the histopathological findings and to study the whole spectrum of adnexal masses. Ovarian tumors contribute to a large number of cases and an important cause of morbidity and mortality in women of reproductive age group. The ovarian tumors are studied with special emphasis.

Aims and Objectives

The aims and objectives of the study are as follows:

- To study the correlation between “*Radiological and histopathological findings in various adnexal masses in a tertiary care center of central India.*”
- Frequency distribution of various adnexal masses by age, anatomic region, and type.
- To study the sensitivity and specificity of the three-pronged approach to clinical diagnosis, ultrasound, and serum CA-125 levels individually in the diagnosis of malignant ovarian tumors.
- To correlate between histopathological and immunohistochemistry findings where ever possible.

MATERIALS AND METHOD

This is a prospective observational study carried out on 60 patients with adnexal masses and pre-operative ultrasound assessment and who underwent surgical resection of their masses from March 2017 to August 2018. Patients with radiological diagnosis and no histopathological reports or vice versa or patients who did not give consent were excluded from the study. The relevant data of the patients including age, parity, clinical presentation, menstrual status, ultrasound

Table 1: Histopathological diagnosis

Histopathological diagnosis	Nature of tumor	Types	Histopathological diagnosis	n (%)
Surface epithelial - tumors	Serous	Benign	Serous cystadenoma	14 (23.3)
		Borderline		0 (0)
		Malignant	Serous cystadenocarcinoma	5 (8.3)
	Mucinous	Benign	Mucinous cystadenoma	10 (16.7)
		Borderline		0 (0)
		Malignant	Mucinous carcinoma	2 (3.3)
	Endometrioid	Benign		0 (0)
		Borderline		0 (0)
		malignant	Endometrioid adenocarcinoma	1 (1.7)
	Clear cell tumors	Benign		0 (0)
Borderline			0 (0)	
malignant			0 (0)	
Sex cord - stromal tumor	Brenner (transitional cell) tumors			0 (0)
	Granulosa - cell tumor			2 (3.3)
	Juvenile granulosa cell tumor			1 (1.7)
	Fibroma thecomas			0 (0)
	Sertoli-Leydig cell tumor			0 (0)
	Other sex cord-stromal tumors			0 (0)
Germ cell tumor	Immature teratoma			0 (0)
	Mature teratoma			6 (10)
	Teratoma with malignant transformation			1 (1.7)
	Dysgerminoma			1 (1.7)
	Yolk sac tumor			2 (3.3)
	Mixed germ cell tumor			0 (0)
Metastatic tumors	Krukenberg tumor			1 (1.7)
Nonovarian lesions	Leiomyoma	Benign		7 (11.7)
	Leiomyosarcoma	Malignant		2 (3.3)
Non neoplastic ovarian lesion	Ectopic pregnancy			3 (5)
	Endometriotic cyst			2 (3.3)

findings, and serum CA-125 levels were recorded in a pro forma.

The surgically resected adnexal masses included:

- Ovarian/oophorectomy specimens, either with an attached fallopian tube or in isolation
- Fallopian tube specimens
- Subserosal fibroid along with uterus cervix or as myomectomy specimen
- Broad ligament fibroid.

RESULTS

Analysis of clinical and histopathological diagnosis was done [Table 2], 38 cases were classified clinically as benign of these 36 were proven benign on histopathology. Two cases, however, were malignant on histopathology. Similarly, 22 cases were classified clinically as malignant of these 16 were proven malignant on histopathology and 6 were benign on histopathology. Thus, 6 cases were false positive on clinical examination and two cases were false negative on clinical examination.

The sensitivity, specificity, and positive and negative predictive value of clinical diagnosis in diagnosing the malignant nature of lesions:

- Sensitivity of clinical diagnosis: 88.9%
- Specificity of clinical diagnosis: 85.7%
- Positive predictive value of clinical diagnosis: 72.7%
- Negative predictive value of clinical diagnosis: 94.7%.

Analysis of radiological and histopathology diagnosis was done [Table 3]. On radiological USG assessment, 24 cases

were classified as malignant of these 17 were proven malignant on histopathology. Thus, seven false positive cases were identified by the radiological assessment. Out of 36 cases classified as benign on USG, 35 proven benign on histopathology. Thus, one case was identified as false negative by USG assessment.

- Sensitivity of ultrasound diagnosis – 94.4%
- Specificity of ultrasound diagnosis – 83.3%
- Positive predictive value of ultrasound diagnosis – 70.8%
- Negative predictive value of ultrasound diagnosis – 97.2%

Analysis of ultrasound features with the gross characteristics of adnexal masses [Table 4]: Majority of the tumors diagnosed by USG as cystic masses were proven benign tumors on histopathology. The tumors classified as solid cystic on USG, 50% were benign and 50% malignant on histopathology. Out of 4 tumors classified as solid on USG three were proven malignant on histopathology and one was a benign tumor.

Analyses of CA – 125 assays levels and benign versus malignant nature of ovarian masses [Table 5]. A total of 24 patients had their serum levels checked for CA – 125. Twelve cases had CA – 125 assays levels raised >35 IU/ml and 12 cases had normal levels of CA – 125. Of the 12 cases of raised CA – 125 levels, ten cases were proven malignant on histopathology, and two cases benign thus, two cases were a false positive. Of the 12 cases of normal levels of CA – 125 assays, ten were proven benign and two malignant on histopathology. Thus, two cases were false negative.

The sensitivity, specificity, and positive and negative predictive value of CA – 125 in ascertaining benign or malignant nature of ovarian neoplasms:

Table 2: Clinical diagnosis versus histopathology report for malignant tumors

Clinical diagnosis	Histopathology report		Total
	Malignancy present	Malignancy absent	
Malignancy present	16	6	22
Malignancy absent	2	36	38
Total	18	42	60

$\chi^2=30.20, P<0.0001$

Table 3: Ultrasound diagnosis versus histopathological report for malignant tumors

Ultrasound diagnosis	Histopathological report		Total
	Malignancy present	Malignancy absent	
Malignancy present	17	7	24
Malignancy absent	1	35	36
Total	18	42	60

$\chi^2=31.76, P<0.0001$

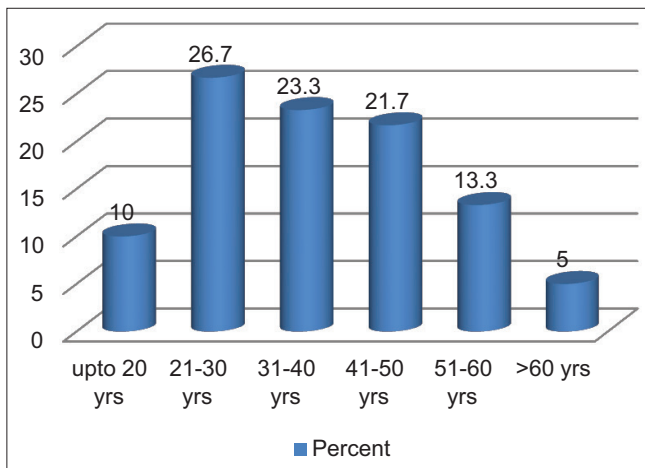
Table 4: Ultrasonography echo pattern versus histopathological gross features of ovarian tumors

Ultrasonography consistency	Histopathology		Total (%)
	Benign (%)	Malignant (%)	
Cystic	17 (56.67)	1 (6.25)	18 (39.13)
Solid	1 (3.33)	3 (18.75)	4 (8.70)
Solid Cystic	12 (40.00)	12 (75.00)	24 (52.17)
Total	30 (100)	16 (100)	46 (100)

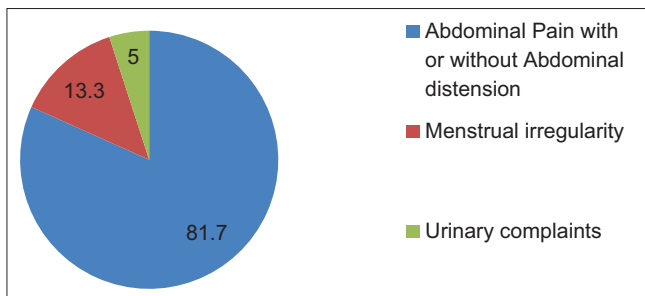
$\chi^2=10.14, P<0.006$

Table 5: CA – 125 assays versus histopathology report for malignant tumors

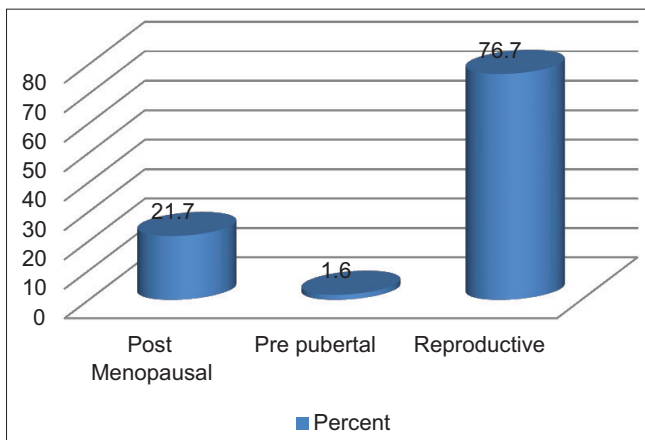
CA – 125 Assays	Histopathology report		Total
	Malignant	Benign	
>35 IU/ml	10	2	12
≤35 IU/ml	2	10	12
Total	12	12	24



Graph 1: Age-wise distribution of cases



Graph 2: Presenting complaints



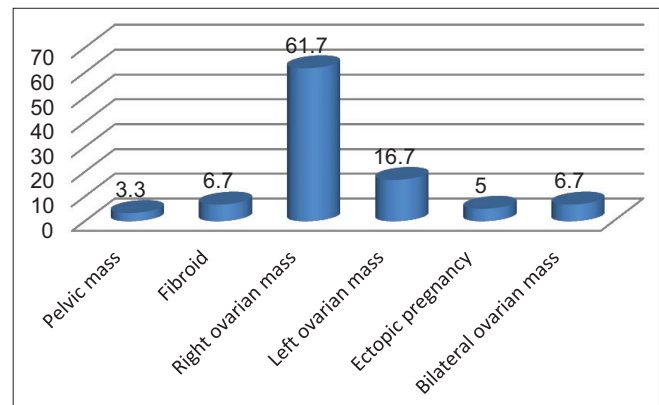
Graph 3: Menstrual status

- Sensitivity: 83.3%
- Specificity: 83.3%
- Positive predictive value: 83%
- Negative predictive value: 83%

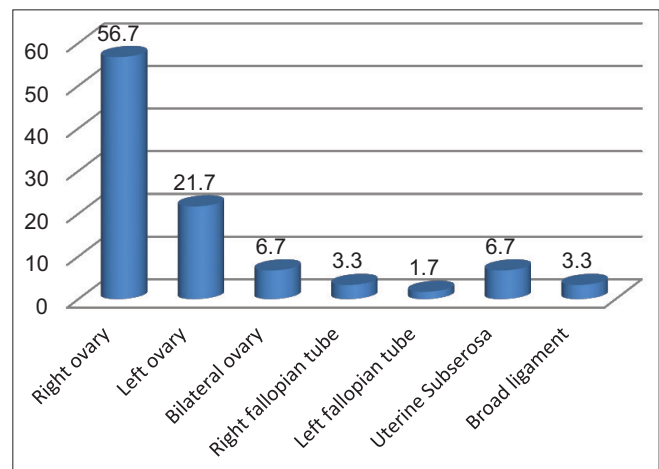
DISCUSSION

Age-Wise Distribution of Adnexal Mass

In the present study, the age range of patients is from 31 to 66 years [Graph 1]. The mean age of patients is 38.3 ±



Graph 4: Clinical diagnosis



Graph 5: Radiologically confirmed site of lesion

13.2. About 71.6% of patients were in the reproductive age group and at the extreme of ages that is below 20 years, and above 60 years, the number of cases was less. The youngest patient in the present study is a 13-year-old girl, belonging to prepubertal age group, presented with pain in abdomen since 2–3 months, she was diagnosed with yolk sac carcinoma measuring 16 cm × 8.1 cm × 6 cm. Germ cell tumor is common in children and young adults. The oldest patient is 66-year-old female with leiomyosarcoma measuring 15 cm × 14 cm × 10 cm.

Presenting Complaints

In the present study, the most frequent presenting symptom was abdominal pain with or without abdominal distension and was present in 81.7% of patients. The second most common symptom was menstrual irregularities, present in 13.3% of patients. Urinary complaints were reported in 5% of patients [Graph 2].

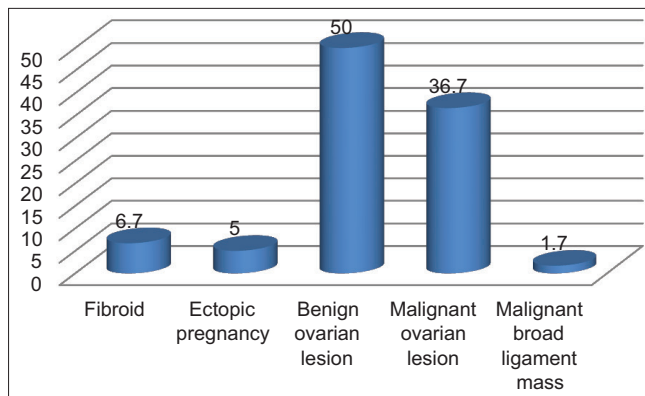
Menstrual Status of the Patients

In our study, 21.7% of patients were postmenopausal and 76.7% of patients belong to the reproductive age group. There is one patient belonging to prepubertal age group [Graph 3].

Similar findings were reported in a study by Dalia *et al.* (2017)^[2] in which 56% of patient belongs to the reproductive age group and 12% were in the menopausal age group. Study Priya and Kirubamani (2017)^[3] revealed similar findings with 62.83% of women belonging to the reproductive age group and 10.6% of women were postmenopausal.

Site of Lesion

In the present study, 85% of adnexal masses are of ovarian origin. About 6.7% of masses are originated from uterine subserosa. About 5% were of fallopian tube origin and only 3% of the masses were of broad ligament origin [Graphs 4-6].



Graph 6: Ultrasound diagnosis

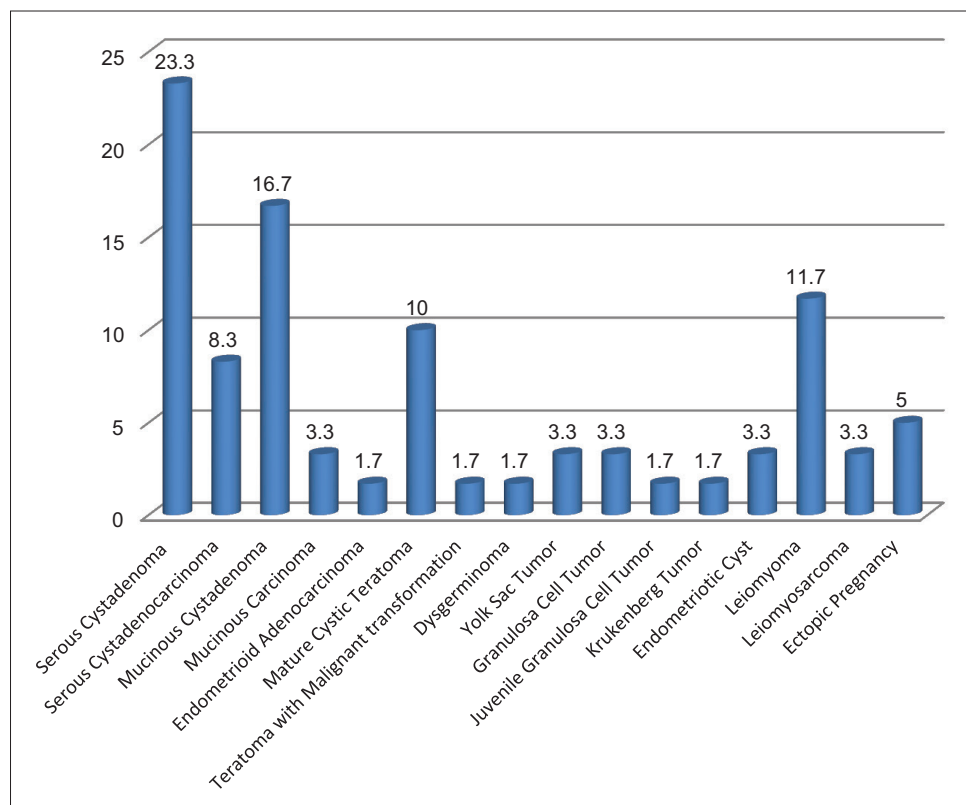
The findings are in concordance with other past studies [Table 6]:

Analysis of Clinical and Histopathological Diagnosis in Determining Malignant Nature of Adnexal Masses Studied

A total of 60 cases of adnexal mass were analyzed out of which 22 cases were diagnosed clinically as malignant, and 38 cases were diagnosed as benign. Out of 22 malignant cases, six cases proved to be benign on histopathology. Hence, six cases were diagnosed with false positive on clinical examination. Out of 38 benign cases, 36 were proven benign on histopathology and two cases were malignant. Hence, two cases were diagnosed with false negative on clinical examination. The sensitivity of clinical diagnosis is 88.9%, specificity of clinical diagnosis is 85.7%, positive predictive value

Table 6: Site (organ of origin) of adnexal mass – comparison with other studies

Study name	Ovary (%)	Fallopian tube (%)	Other causes (%)
Radhamani <i>et al.</i> (2017) ^[5]	93	-	-
Prasad <i>et al.</i> (2017) ^[4]	96	4	-
Dalia <i>et al.</i> (2017) ^[2]	84	14	2
Bhagde (2016) ^[168]	78	16	6
Present study	85	5	10



Graph 7: Histopathological diagnosis [Table 1]

is 72.7%, and negative predictive value is 94.7% in our study.

A study by Priya and Kirubamani (2017),^[3] a total of 113 cases were analyzed and 39 cases were diagnosed malignant on clinical assessment out of which 25 were proven benign on histopathology and 14 as malignant. Hence, 25 false positive cases were diagnosed on clinical examination. Out of 74 cases classified as benign on clinical examination, 72 cases were benign and two cases were malignant. Hence, two cases were diagnosed with false negative on clinical examination.

The findings of the study are concordant with our study with regard to the specificity of clinical examination. The higher degree of sensitivity of clinical examination in our study was due to a thorough preoperative assessment of the patients presenting with adnexal masses which included bimanual pelvic examination, radiological assessment, and measurement of CA – 125 assays. All the modalities of pre-operative diagnosis combined together increases the overall sensitivity of clinical diagnosis of adnexal masses.

Diagnostic Accuracy of USG in Differentiating benign from Malignant Lesions

Analysis of the 60 adnexal masses revealed that 17 cases were identified true positive and 35 cases were identified as truly negative. Seven cases were identified as false positive and one was identified as a false negative. The sensitivity was 94.4%, specificity was 83.3%, positive predictive value was 70.8%, and negative predictive value was 97.2%. The findings of our study were concordant with the study by Praad *et al.*^[4] in which USG showed the sensitivity of 92%, specificity of 89%, positive predictive value of 92%, and negative predictive value of 89% in differentiating benign from malignant lesions. A study by Priya and Kirubamani^[3] showed USG sensitivity of 88% and specificity of 80.68% in prediction of ovarian cancer. The findings are similar to our study. A study done by Radhamani and Akhila^[5] revealed that USG had sensitivity of 87.5% and specificity of 95.65% with an accuracy of 95% for predicting ovarian cancer. In a study by Rathore *et al.*,^[6] USG showed sensitivity of 100%, specificity of 88.4%, and accuracy of 90.3% in diagnosing malignancy in adnexal masses [Table 7].

Histopathological Distribution of the Adnexal Masses

In our study, the most common histologically confirmed ovarian tumor is serous cystadenoma followed by mucinous cystadenoma and germ cell tumors [See Graph 7]. Majority of the studies conducted showed similar findings as our study.

In a study by Prakash *et al.* (2017),^[7] serous cystadenomas were the most common ovarian tumors diagnosed, accounting for 64.5%. Mucinous cystadenomas were the second most common benign tumor diagnosed, accounting for 24.2%.

A study conducted by Fatima *et al.* (2017),^[8] serous cystadenomas was the most common ovarian tumor diagnosed accounting for 54% of cases. Mucinous cystadenomas were the second most common tumor diagnosed.

In a study by Patel *et al.* (2018),^[9] serous cystadenomas accounted for 57.4% of ovarian tumors and were the most common benign tumor reported. Mucinous cystadenomas accounted for 16% and were the second most common benign tumor reported.

Incidence of Ovarian Tumors as benign Malignant

In our study, 46 cases of the ovarian tumor were reported out of the 46 tumors, 30 were benign tumors, and 16 were malignant. Similar incidence was recorded in many different studies where the incidence of benign tumors was more than malignant [Table 8].

As the study was conducted in medical college, which is a tertiary care center we have a higher incidence of malignant cases as compared to other studies.

CA – 125 Values in Diagnosis of Benign and Malignant Tumors

Serum CA – 125 assays is a valuable preoperative parameter for both diagnosis and monitoring of ovarian epithelial carcinoma.

In our study, serum CA – 125 assays were done in 24 patients of ovarian neoplasms. The analysis was done to assess the role of CA – 125 values in the diagnosis of benign and malignant tumors. Out of 24 patients,

Table 7: Sensitivity, specificity, positive predictive value, and negative predictive value of ultrasound – comparison with past studies

Study name	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Prasad <i>et al.</i> ^[4]	92	89	92	89
Rathore <i>et al.</i> ^[6]	100	88.4	-	-
Dalia <i>et al.</i> ^[2]	71	73.33	71	73
Radhamani <i>et al.</i> ^[5]	87.5	95.65	-	-
Priya <i>et al.</i> ^[3]	88	80.68	-	-
Present study	94.4	83.3	70.8	97.2

Table 8: Incidence of benign and malignant nature of adnexal mass

Study name	Benign (%)	Malignant (%)
Patel <i>et al.</i> (2018) ^[9]	93.2	6.2
Dalia <i>et al.</i> ^[178]	90	10
Fatima <i>et al.</i> ^[172]	72	13
Priya <i>et al.</i> ^[175]	78	21
Radhamani <i>et al.</i> ^[167]	90.46	9.5
Present study	66	34

12 patients had raised levels (>35 U/ml) in serum and 12 had normal levels (<35 U/ml).

Of the 12 patients with raised CA – 125 level 10 cases were proven malignant on histopathology and two were benign. Of the 12 patients with normal levels of CA – 125, ten were proven benign, and two were malignant on histopathology. The overall sensitivity was 83.3%, specificity was 83.3%, positive predictive value of 83%, and negative predictive value of 83% with the confidence interval of 51.6–97.9.

The overall sensitivity of CA – 125 screening in distinguishing benign from malignant adnexal masses reportedly ranges from 61% to 90%, specificity ranges from 71% to 93%, positive predictive value ranges from 35% to 91%, and negative predictive value ranges from 67% to 90%.^[10] The values are similar to our study. Thus, in our study, CA – 125 levels were sensitive and specific in ascertaining the malignant nature of ovarian neoplasms.

A study by Radhamani and Akhila (2017)^[5] showed a sensitivity of 62.5% and specificity of 84.25% in ascertaining the malignant nature of ovarian neoplasms.

Ultrasound Echo Pattern of Ovarian Masses in Relation to Histopathology

In our study, the majority of the ovarian tumors diagnosed by USG as purely cystic in architecture were proven benign tumors on histopathology. The tumors classified as solid-cystic in architecture on USG, 50% were diagnosed as benign and 50% malignant on histopathology. Out of the four tumors classified as solid on USG, three were proven malignant and one was benign on histopathology.

The findings were similar to a study by Hassan *et al.*^[11] In our study, the majority of the cystic masses diagnosed by USG were proven benign 64.04% on histopathology. Out of 6 solid masses, four were proven malignant on histopathology. Moreover, out of eight solid-cystic masses, seven were benign and one was malignant on histopathology.

In a study by Priya and Kirubamani (2017),^[3] similar findings were recorded. Out of the cystic masses, majority

were benign on histopathology. Solid tumors turned out to be malignant. Among solid-cystic tumors majority were malignant on histopathology.

Cases

- Case 1 – A 48 years old with metastatic adenocarcinoma signet ring cell type (Krukenberg Tumor) [Figure 1a-e].
- Case 2 – Leiomyosarcoma [Figure 2a-e].
- Case 3 – Low grade papillary serous cystadenocarcinoma ovary in 27 years old [Figure 3a-e].

USG revealed the presence of a large ill-defined multilocular cystic mass of size approximately 13.6 cm × 8 cm in the pelvic region. Uterus displaced anteriorly with the minimum endometrial collection. Bilateral ovaries are not visualized.

Computed tomography findings revealed multiseptated mass-like lesion in the pelvic region with septations and gross ascites suggestive of cystic ovarian growth.

CA – 125 level – 802 U/ml.

On gross examination a creamish color mass measuring 10 cm × 4 cm × 3 cm partially capsulated showing papillary projections on a surface measuring 1.5 cm × 1.5 cm. On cut section, multilocular, cystic area, and few cysts filled with thick mucoid material. Cystic area measuring 1.5 cm × 1.5 cm. One cyst showing papillary projections measuring 3 cm × 1 cm. Wall thickness varies from 0.2 cm to 0.4 cm.

The IHC panel of markers with showed immunoreactivity is Cytokeratin 7, KI 67 (Positive 10–20%), P53 (weak positive). Cytokeratin 20, Vimentin, and WT1 were negative. A diagnosis of low-grade serous cystadenocarcinoma was made.

- Case 4 – Dysgerminoma [Figure 4]
- Case 5 – Mature cystic teratoma [Figure 5]
- Case 6 – Serous cystadenoma [Figure 6].

SUMMARY

Adnexal masses were found to be more common in the reproductive age group. The premenopausal age group was more frequently affected than post-menopausal age group. Majority of the patients presented with abdominal pain associated with or without abdominal distension as the most frequent presenting symptom. Majority of the patients were clinically diagnosed as ovarian masses. A large number of adnexal masses were of ovarian origin. There were cases of fallopian tube origin and also broad ligament origin masses. USG diagnosis of adnexal masses revealed a sensitivity of 94.4%, specificity of

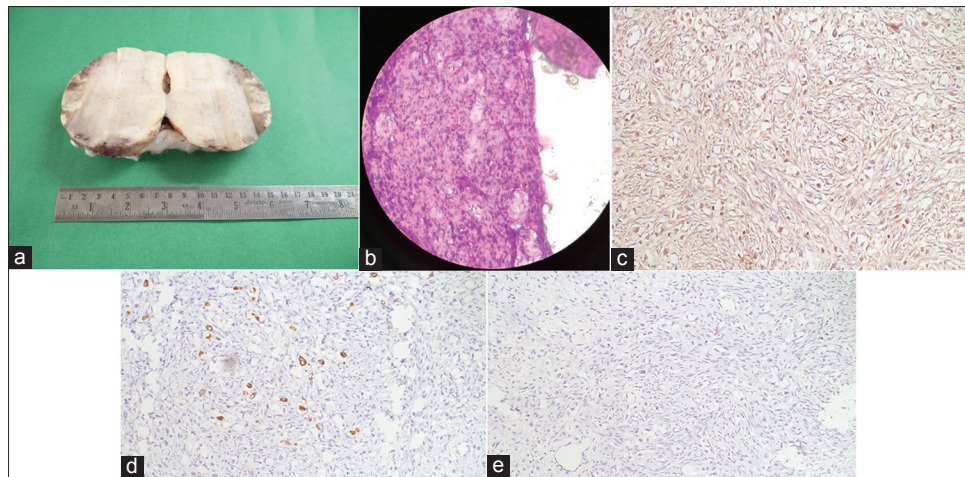


Figure 1: (a) A 48 years old with metastatic adenocarcinoma signet ring cell type (Krukenberg Tumor). Cut section showing solid homogenous tan white and fleshy appearance. (b) Microscopic image showing signet ring cells infiltrating within the cellular and fibrotic stroma. (c) ×20 low power view cytoplasmic positivity for CK7. (d) ×20 low power view CK 20 positivity. Tumor cell shows focal positivity for CK20. (e) ×20 low power view negative for CA125

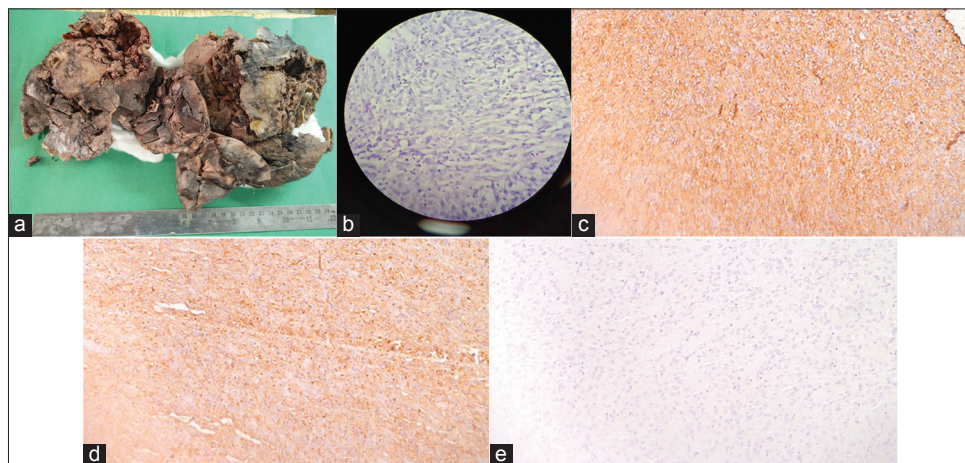


Figure 2: (a) A case of leiomyosarcoma in a 66 years old. Cut section large variegated mass with solid cystic areas and foci of hemorrhage and necrosis. (b) Microscopic image showing hypercellularity pleomorphism, atypical mitoses. (c) ×20 low power view showing positivity for vimentin. (d) View ×20 low power showing positivity for CD117. (e) View ×20 low power negative for desmin

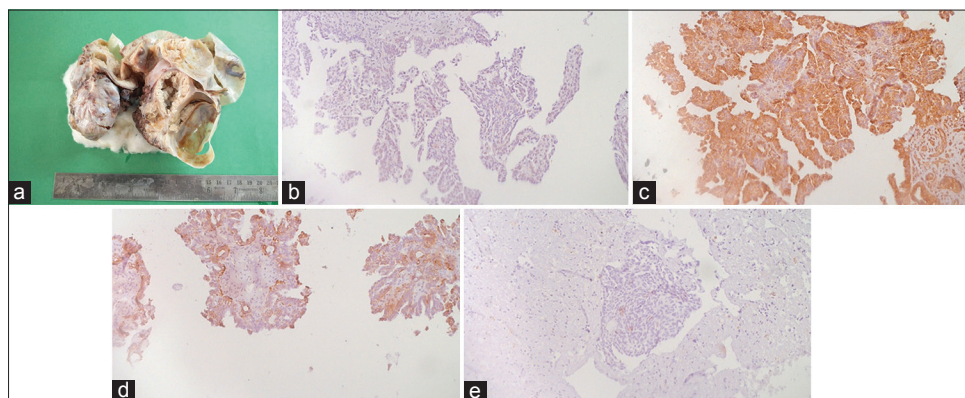


Figure 3: (a) Papillary serous cystadenocarcinoma in a 27 year old. On cut section the tumor is solid cystic with necrotic areas and papillary projections. (b) ×20 low power view showing weak positivity for P-53. (c) ×20 low power view negative for WT1. (d) ×20 low power view positive for CK7. (e) ×20 low power view negative for CK20



Figure 4: Gross image of dysgerminoma. Cut section shows solid homogenous tan color



Figure 5: Gross image of mature cystic teratoma. Cut section cyst filled with greasy material, composed of keratin and sebum

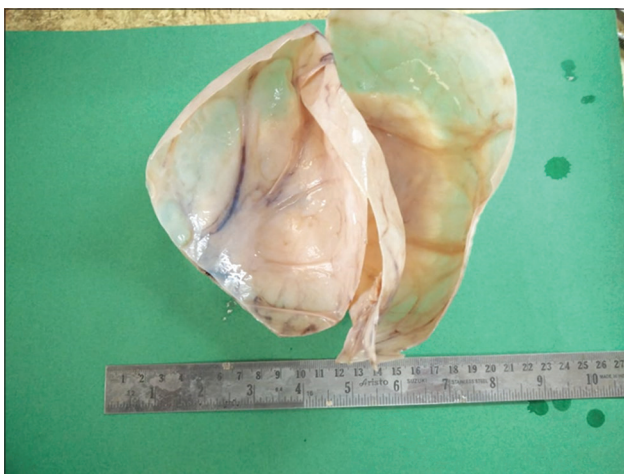


Figure 6: Gross image of serous cystadenoma. Cut section unilocular smooth outer and inner surfaces

83.3%, positive predictive value of 70.8%, and negative predictive value of 97.2%. USG is a sensitive and specific

modality in pre-operative diagnosis of the malignant nature of lesions. The clinical diagnosis of adnexal masses revealed a sensitivity of 88.9%, specificity of 85.7%, positive predictive value of 72.7%, and negative predictive value of 94.7%. Although the clinical diagnosis is a less sensitive in predicting pre-operative diagnosis of the malignant nature of lesions, our study showed the clinical diagnosis is sensitive in pre-operative diagnosis of the malignant nature of masses. The incidence of neoplastic adnexal masses is much higher than the non-neoplastic masses. Among the neoplastic adnexal masses majority were ovarian tumors. The incidence of benign ovarian tumors is higher than malignant tumors. Surface epithelial ovarian tumors were the most common category followed by germs cell tumors. Benign serous cystadenoma was the most common ovarian tumor followed by benign mucinous cystadenoma. Among the malignant tumors, serous cystadenocarcinoma was the most common tumor followed by granulosa cell tumor. Mature cystic teratoma was the most common germ cell tumor. Majority of the ovarian tumors diagnosed by USG as purely cystic in architecture were proven benign tumors on histopathology. Of the solid-cystic tumors, 50% were benign and 50% malignant on histopathology solid architecture of the tumors was the least common, and majority were malignant. CA – 125 is an important tumor marker in preoperative evaluation and ascertaining the malignant nature of ovarian neoplasms.

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Evaluation of Functional Results in the Management of Supracondylar Fracture of Humerus in Children by Various Methods

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Abstract

Introduction: Supracondylar fractures of Humerus are one of the most common fractures in pediatric age group. The aim of the study was to evaluate the functional results in the management of supracondylar fracture of humerus in children by various methods.

Materials and Methods: This study was conducted at the Orthopaedics department of Mahatma Gandhi Memorial Hospital, Warangal. This was a 2 years prospective, longitudinal, hospital based, observational study and its outcomes. Participants were a total of 30 children aged 0 to 14 years (21 males, 9 females) diagnosed with supracondylar fracture of humerus.

Results: Patients were assessed by Flynn's criteria. Results were excellent in 70%, good in 20%, fair in 6.66%, and poor in 3.33%.

Conclusion: Closed reduction and external immobilization are reserved for Gartland's type 1 and select type 2 fractures. In unstable type 2 and type 3, closed or open reduction and K-wire fixation give better results.

Key words: Flynn's criteria, Open reduction and internal fixation, Percutaneous pinning, Supracondylar fracture of humerus, Traction

INTRODUCTION

At the end of 19th century, Sir Robert Jones echoed the opinion of that era about elbow injuries. "The difficulties experienced by surgeons in making an accurate diagnosis; the facility with which serious blunders can be made in treatment and prognosis; and fear shared by so many, of subsequent limitations of function, serve to render injuries in the neighborhood of elbow less attractive than might otherwise prove.^[1] These concerns are applicable even today.

Supracondylar fractures of humerus account for 50–70% of fractures around the elbow in children^[2] and 12–17% of all pediatric fractures. Peak incidence is from 5 to 8 years of age.^[3]

The medial and lateral columns of the distal humerus are connected by a thin segment of bone between the olecranon fossa posteriorly and coronoid fossa anteriorly, resulting in high risk of fractures of this area. The metaphysis is thinned both anteriorly by coronoid fossa and posteriorly by olecranon fossa to accommodate the upper end of the ulna during flexion and extension, respectively. The metaphyseal flare of the distal humerus connects the diaphysis of the humerus to the epiphysis.

The most common mechanism of injury is when a patient falls on the outstretched hand with the elbow fully extended. The olecranon engages with the olecranon fossa and acts as a fulcrum, while anterior capsule simultaneously provides a tensile force on distal humerus at its insertion. The flexion

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injury results from direct trauma to the posterior aspect of the distal humerus or falling onto the point of flexed elbow.

Supracondylar fractures are known for its complications because of the inherent fracture instability, close vicinity of the brachial artery and major nerves of extremity, poor radiographs, and poor interpretations of reduction.

The following are treatment modalities available in the management of supracondylar fracture of humerus

1. Closed reduction and immobilization in an above elbow plaster cast
2. Closed reduction and percutaneous pinning (CRPP) under image intensifier
3. Open reduction and internal fixation (ORIF) with k wires (2 lateral pins, one medial pin and one lateral pin [cross pinning], two lateral, and one medial pin)
4. Lateral external fixator
5. Overhead olecranon wingnut traction
6. Straight arm skeletal traction.

We conducted a study with the purpose of assessing the results and functional outcomes of management of supracondylar fracture of humerus by various methods in our institution.

METHODOLOGY

This study comprises 30 patients who are diagnosed to have a supracondylar fracture of humerus admitted in Mahatma Gandhi Memorial Hospital (Tertiary care institution at Warangal, Telangana state) from December 2016 to November 2018.

All patients and their parents were informed about the study, and their consent was obtained about their inclusion in this study. Ethical approval was taken from the Institutional Ethics Committee.

Inclusion Criteria

Age of patient 1–14 years was included in the study.

All types of supracondylar fracture of the humerus.

Exclusion Criteria

The following criteria were excluded from the study:

- Age of patient above 14 years.
- Patient with supracondylar fracture having an intercondylar extension.
- Floating elbow injuries.
- Patient presenting with infection at the site of fracture.
- Patient not seeking treatment according to our protocol.

Data Recording (Clinical and Radiological)

As soon as, the child is admitted in hospital with elbow injuries, a detailed careful history is elicited from patients and from their parents in young children, with regard to mode of injury and time since injury. A physical examination was conducted and evaluation of patients was done in terms of swelling at elbow, deformity, painful range of motion (ROM), closed or open fracture, and puckering of the skin. Presence or absence of radial pulse, nail bed capillary refill time and signs of compartment syndrome, neurological status in radial, median, and ulnar nerve territories and other associated musculoskeletal injuries.

An initial radiological evaluation was done by obtaining anteroposterior and lateral views of affected elbow [Figure 1a], and after manipulation with or without pinning, jones view was evaluated.

In this study, supracondylar fractures of the humerus were classified according to Gartland's classification.^[4] There are two types of fractures, extension type (96–98%)^[5] and flexion type (2–4%) depending on the sagittal tilt of the distal fragment.

- Type 1 – Undisplaced
- Type 2 – Displaced with intact posterior cortex, may be angulated or rotated
- Type 3 – Displaced with no cortical contact
- 3a – posteromedial
- 3b – posterolateral.

In the meantime, analgesics were given and fracture part was splinted temporarily [Figure 1b]. Before surgery, the necessary laboratory investigations were done.

Management Protocol

The protocol was drawn according to the type of fracture.

Type 1 fractures – The affected limb was immobilized in above elbow posterior splint with elbow in $\leq 90^\circ$ flexion and forearm in neutral rotation. Cuff and collar were applied. The patient was reviewed after 3 days and if any loosening of splint was seen, it was corrected with instructions to review after 3 weeks. At the end of 3 weeks, splint was removed, and X-rays were repeated to assess the fracture healing. The patient was advised to do active ROM exercises at the elbow.

Type 2 fractures – under general anesthesia, closed reduction was carried out by giving longitudinal traction to the forearm by the surgeon and counter traction to the proximal arm by the assistant. The elbow is flexed up to 90° and the distal fragment is pushed anteriorly. The further elbow was flexed up to 120° and forearm was fully pronated and distal vascular status was assessed. After reduction has

been confirmed by fluoroscopy, it can be maintained by two methods.

- To apply an above elbow plaster splint at 120° of flexion and patient was given cuff and collar for 3 weeks.
- If the fracture is unstable (if there is medial column comminution), or if the reduction cannot be maintained without excessive flexion, which may place vascular structures at risk; the fracture was fixed with percutaneous K wires (cross pins or two lateral pins)^[6,7] and an above elbow plaster splint was applied for 3 weeks. The patient was discharged at 24 h and advised to review after 3–4 weeks. X-ray was repeated and if healing was satisfactory, slab was removed and ROM exercises of elbow encouraged.

Advantages of Percutaneous Pinning

- It is done without opening the fracture
- Less chances of infection
- Provides strong fixation and stability in any position of elbow
- Elbow can be mobilized early.

Technique of CRPP. Under general anesthesia, the patient was placed in supine position on the operation table after which closed reduction was done by giving longitudinal traction applied to forearm with an elbow in extension and forearm in supination. Counter-traction to the proximal arm was provided by the assistant. With the traction being maintained, the medial or lateral displacement was corrected by applying a varus or valgus force at the fracture site. The displacement and angulation of the distal fragment were corrected by flexing the elbow, at the same time a posteriorly directed force was applied to anterior portion of arm over the proximal fragment and then anteriorly directed force was applied over the distal fragment with thumb on the olecranon and elbow is hyper flexed and forearm is pronated to maintain reduction. Reduction is checked under fluoroscope by taking an anteroposterior view and lateral view of elbow. Maintenance of reduction was achieved by passing one lateral pin with elbow in flexion and one medial pin with an elbow in extension (to avoid ulnar nerve injury). Once the pins were in place, the fixation was checked under fluoroscope [Figure 1c]. After leaving about 1 cm of pins outside the skin, the pins were bent and cut off and a well-padded posterior above elbow slab was applied with elbow flexed to $\leq 90^\circ$ flexion, ensuring distal vascularity.

In the post-operative period, the limb was kept elevated. Antibiotics and analgesics were given for 3–5 days. Dressing was changed usually on 2nd, 5th, and 7th day. The posterior slab was reapplied and the patient was asked to review after 3–4 weeks. X-ray was taken and if evidence of union is

present, K-wires were removed, and ROM exercises of elbow encouraged.

Type 3 fractures – Under general anesthesia, closed reduction of fracture was done and fracture was fixed with percutaneous K-wires, similar to the technique described for type 2 fractures.

Indications for ORIF were:

- 2–3 attempts of failed closed reduction
- When closed reduction is unsatisfactory
- If the swelling of elbow is grotesque, that closed reduction cannot be maintained
- Type 3 fractures with puckering of the skin
- Open fractures that require irrigation and debridement
- Fractures complicated by vascular injury.

Technique of ORIF

After administration of general anesthesia, the patient was placed in lateral decubitus position with the extremity supported on a sandbag. No tourniquet was used. Intravenous antibiotic (ceftriaxone) was administered before the start of the procedure. The extremity was prepared from axilla to the wrist and painted with betadine solution. A standard posterior approach was used in all patients. The fracture was exposed and the hematoma and debris were cleared, the fracture was reduced and fixed with 2–3 Kirschner's wire of diameter 1.5–2.5 mm. The lateral wire was inserted through the anterior side of the lateral condyle and was directed posteriorly into the posteromedial side of the opposite cortex. The medial wire was started through the posteromedial side of medial condyle (great care is taken to avoid the ulnar nerve) and engaged into the anterolateral side of opposite cortex. The stability of the fracture fixation was checked and wire fixation was checked under image intensifier. K-wires were bent and cut outside the skin. Hemostasis was secured and wound was closed in layers and sterile dressing was applied. A posterior long arm splint was applied with an elbow in 90° flexion and forearm in mid-prone position.

In the post-operative period, the limb was kept elevated. Antibiotics and analgesics were given for 3–5 days. Dressing was changed usually on 2nd, 5th, and 7th days. Sutures were removed on the 10th day. Posterior slab was reapplied and the patient was asked to review after 3–4 weeks. X-ray was taken and if evidence of union is present, K-wires were removed and ROM exercises of elbow encouraged.

Follow-Up Protocol

The patients were advised to attend outpatient department at regular intervals (3 weeks, 6 weeks, 3 months, 6 months,

and 1 year), for checkup and to note the progress of union (radiological) [Figures 1d,e] and movements at elbow, onset of any deformity (clinical). ROM [Figure 1f] and carrying angle [Figure 1g] were measure by goniometer.

OBSERVATIONS AND RESULTS

In the present study, the results were evaluated according to Flynn's criteria^[8] which is based on change in carrying angle and loss of movement after treatment.

Flynn's criteria			
Result	Rating	Cosmetic factor (loss of carrying angle in degrees)	Functional factor (motion loss in degrees)
Satisfactory	Excellent	0–5	0–5
	Good	6–10	6–10
	Fair	11–15	11–15
Unsatisfactory	Poor	>15	>15

Franke *et al.*^[9] in study of 106 patient with displaced supracondylar fracture of humerus treated with CRPP showed 85.7% with very good to good results, 10.7% with satisfactory results, and 3.6% with unsatisfactory results.

Ababneh *et al.*^[10] in his retrospective study of 135 patients with displaced supracondylar fracture humerus treated with three different methods, the results of CRPP were superior with excellent and good results in 87% patients and poor results in 8% patients.

Boparai *et al.*^[11] studied 50 cases of supracondylar fracture and found 80% had good results and 20% had unsatisfactory results in ORIF group compared to 44% unsatisfactory results in the closed reduction and percutaneous pinning group.

In the present study, out of 30 patients, 90% were good to excellent results and 10% proved fair and poor results, according to Flynn's criteria.

DISCUSSION

Age Distribution

Musa *et al.*^[12] conducted a prospective study based on 30 cases with Gartland type 3 supracondylar fracture of humerus managed with crossed percutaneous pinning over a period of 2 years. Age group was 2–13 years with a mean age of 7.06 years. In our study, the average age is 7 years and the most common age group affected was between 5 and 8 years [Table 1].

Sex Distribution

Pirone *et al.*^[13] in their study of 230 patient with a supracondylar fracture of humerus showed that boys (119) were affected more than girls (111)

D'Ambrosia in his series found the incidence of supracondylar fracture in males is 63% and females are 37%.

In the present study, the incidence is 70% in males and 30% in females [Table 2].

Incidence of Fracture type: (Gartland's Classification)

Pirone *et al.* studied that 230 cases of supracondylar fracture and observed 137 were type three fractures and 93 were type 2 fractures.

In type 3 fractures, 94 cases were posteromedial displacement and 22 were with posterolateral displacement and 21 with direct posterior displacement.

Mehlman *et al.*^[14] during the study of operative management of supracondylar fracture of humerus in children found that 77.4% were type three fractures and 18.3% were type 2 fractures.

In the present study, 10% were type 1 and type 2 is 26.66% and type 3 is 63.33% [Table 3].

Side Involvement

D'Ambrosia^[15] found that the involvement of left elbow was 64% and the right elbow was 36%. Ahmed *et al.*^[16] in their series showed a predominance of the left elbow.

Table 1: Distribution based on age

Age in years	Number of patients	Percentage
0–4	3	10
5–8	13	43.33
9–12	11	36.66
13	3	10

Table 2: Distribution based on sex

Sex	Number of patients	Percentage
Male	21	70
Female	9	30

Table 3: Distribution based on the type of fracture

Type of fracture	Number of patients	Percentage
Type 1	3	10
Type 2	8	26.66
Type 3	19	63.33

In our study, the left side was involved in 73.33% and the right side was 26.66% [Table 4].

The incidence in the present study is consistent with the above series.

Treatment Modality Employed [Table 5]

Traction was not used in the management of patients in our study, as its popularity has decreased due to concerns of cubitus varus, pin complications, compartment syndrome and prolonged stay in the hospital though Maffulli *et al.*^[17] and Piggot *et al.*^[18], reported excellent results in their case series of cases managed by traction.

Table 4: Distribution based on the side affected

Side	Number of patients	Percentage
Right	8	26.66
Left	22	73.33

Table 5: Distribution based on treatment modality

Treatment modality	Number of patients	Percentage
Traction	0	0
Closed reduction and cast application	6	20
Closed reduction and percutaneous pinning	17	56.66
Open reduction and k wire fixation	7	23.33

Table 6: Distribution based on pin construct

Type of construct	Number of patients	Percentage
2 lateral pins	2	8.33
1 lateral pin and 1 medial pin	19	79.16
2 lateral and 1 medial pin	3	12.50

Table 7: Distribution of incidence of post-operative complications

Complication	Number of patients	Percentage
Cubitus varus deformity	1	4.16
Pin tract infection	1	4.16
Nerve injury	0	0
Proximal migration of pin	0	0
Restriction of movements	2	8.33

Table 8: Final results

Result	According to loss of motion in degrees		According to loss of carrying angle in degrees		Average percentage
	Number of patients	Percentage	Number of patients	Percentage	
Excellent	21	70	21	70	70
Good	6	20	6	20	20
Fair	2	6.66	2	6.66	6.66
Poor	1	3.33	1	3.33	3.33

6 cases were treated by closed reduction and cast application. 17 cases were treated by closed reduction and percutaneous pinning. 7 cases were treated by open reduction and K-wire fixation.

Pin Construct

The optimal method of pin fixation varies among the authors and convincing evidence regarding pin construct is lacking in literature.

Swenson, Casiano and Flynn used two pins: one medial and one lateral. Arino used two lateral pins.

Fracture geometry, stability of fixation and surgeons preference come into consideration with regards to pin configuration. In present study of 30 cases, we fixed 24 cases of supra condylar fracture of humerus and our preferred construct was cross pinning as it provides biomechanically stable construct.^[19]

We did 1 lateral and 1 medial pin fixation in 19 cases, 2 lateral pins in 2 cases and 2 lateral and 1 medial pin in 3 cases [Table 6].

Pin Tract Infection

Pirone *et al.* studied 230 cases of displaced supracondylar fracture of the humerus and observed that in 78 cases treated with CRPP, 2 cases had pin tract infection.

Cramer *et al.*^[20] in his retrospective study of 29 children with supracondylar fracture of humerus; treated with CRPP in 15 children and open reduction and pinning in 14 children, only one patient in CRPP showed superficial infection.

Lejman *et al.*^[21] showed no case of pin tract infection in 20 cases of supracondylar fracture of humerus treated with CRPP.

In the present study, one patient had evidence of pin tract infection in 7 cases treated with open reduction and pinning [Table 7]. Infection was treated by antibiotics and regular dressings.

Cubitus Varus

Topping *et al.*^[22] showed the incidence of cubitus varus in one patient out of 47 cases treated with CRPP.

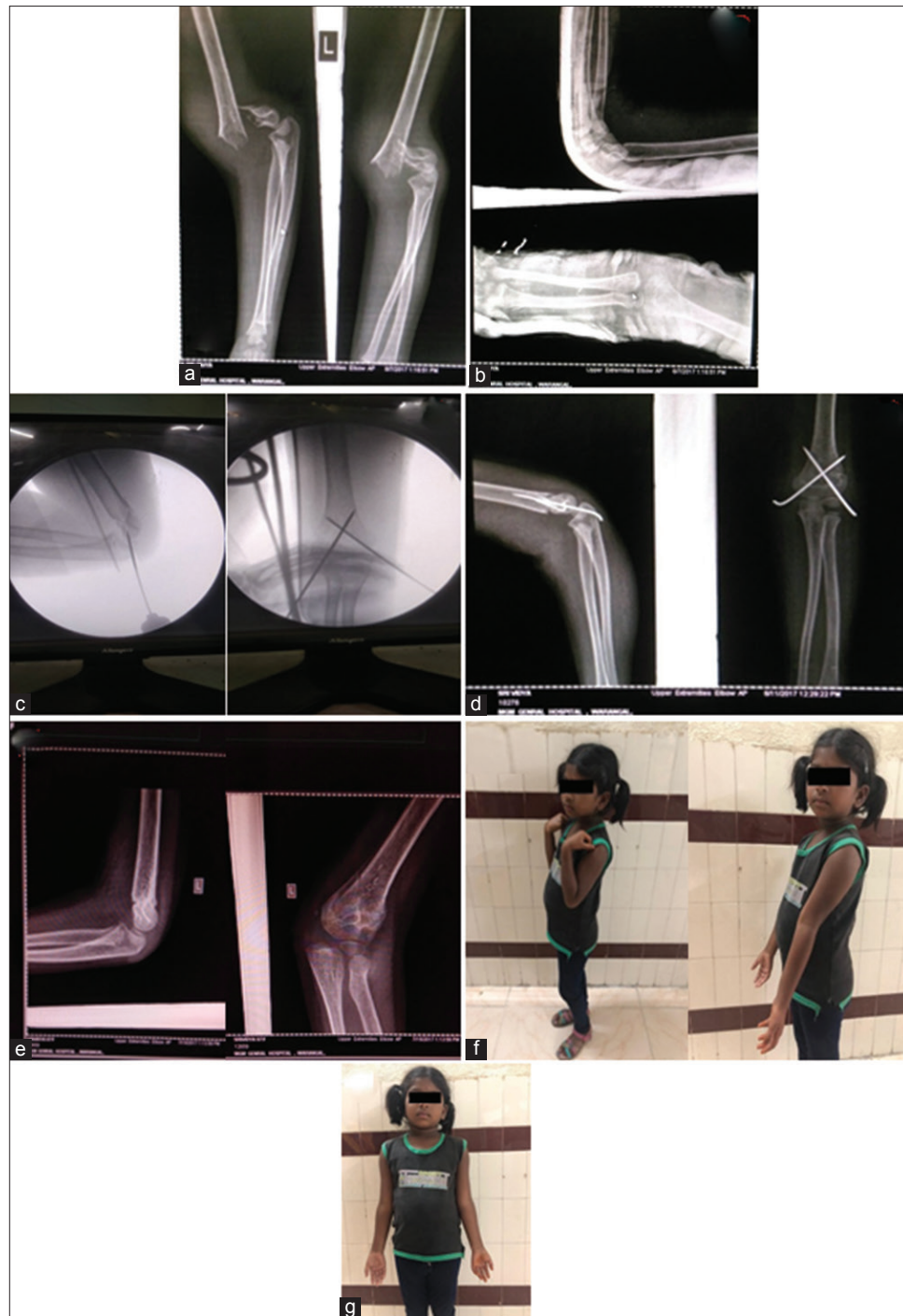


Figure 1: (a) X-ray of the elbow anteroposterior and lateral view showing supra condylar fracture of humerus. (b) X-ray showing immediate splinting of supracondylar fracture of humerus. (c) Intraoperative fluoroscopic images showing fracture fixation with K-wires. (d) Post-operative X-ray showing fracture fixation with K-wires. (e) Late post-operative follow-up X-rays showing evidence of fracture union. (f) Clinical pictures showing functional results during follow-up period: Flexion and extension movements at elbow, respectively. (g) Clinical picture showing carrying angle at elbow during follow-up

Kennedy *et al.*^[23] observed two cases of cubitus varus among 40 cases of displaced supracondylar fracture in children. In our study, two patients developed cubitus varus. This deformity is seen with one patient in open reduction and pinning group [Table 7].

Proximal Migration of K Wire

Pirone *et al.* observed the migration of one lateral pin, out of 96 cases treated with CRPP. In the present study, we did not see this complication [Table 7].

RESULTS

Patients were assessed by Flynn's criteria. Results were excellent in 70%, good in 20%, fair in 6.66% and poor in 3.33% [Table 8].

CONCLUSION

The outcomes of treatment of the supracondylar fracture of humerus in children depend on perfect anatomical reduction and stable immobilization.

In type 1 undisplaced fractures, treatment is immobilization in an above elbow plaster splint for 3–4 weeks.

In type 2 fractures

- Closed reduction and immobilization in above elbow plaster splint is done provided no gross angulation at the fracture site and if the reduction is stable
- Closed reduction and fixation with percutaneous k wire fixation (CRPP), if fracture shows the great collapse of the weakened medial column and if the fracture is unstable.

In Type 2 and 3 fractures, where closed reduction is not satisfactory and also in open fracture, treatment is by open reduction and fixation with K wires, one from medial and one from the lateral side of lower end of the humerus (cross pins) or 2 lateral pins.

In the present study, the above protocol of treatment of supracondylar fractures of the humerus has given good cosmetic and functionally satisfactory results.

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A Cross-Sectional Study of Premenstrual Dysphoric Disorder (PMDD) in Nursing Staff of Tertiary Care Center in One of the Aspirational District of North India and its Relationship with Quality of Life and Self-Esteem

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Abstract

Introduction: Menstruation is a physiological process. Premenstrual dysphoric disorder (PMDD) is a hormone-based mood disorder causing a severe and debilitating form of premenstrual syndrome. The diagnosis of PMDD is considered as per the Diagnostic and Statistical Manual of Mental Disorder – fourth edition (DSM-IV).

Aims and Objectives: The aim of the study was to study premenopausal dysphoric disorder in nursing staff of tertiary care center in one of the aspirational district of North India and its relationship with quality of life (QOL) and self-esteem.

Materials and Methods: A cross-sectional study was done among 150 female nursing staff (of menstrual age) working in the medical college and hospital. Premenstrual symptoms screening tool, Rosenberg self-esteem scale, the women's QOL questionnaire were used. A proper performance was given to each subject. The questioner was based on DSM-IV criteria. The subject had to answer "yes" or "no." The subjects were classified according to the presence of symptoms. The presence or absence of depressive symptoms was assessed using Hamilton Depression Rating Scale.

Results: As per DSM-IV criteria for the diagnosis of PMDD, in our study out of a total of 150 subjects, 13 suffered from PMDD. Our prevalence rate came out to be 8.67%.

Conclusion: The study of PMDD is highly useful because it makes us realize that the suffering of women having PMDD is genuine and we cannot ignore these symptoms. We have to be very considerate to them, and all modalities of treatment should be given to relieve the women of their sufferings and to reduce the physical and psychological distress. The need of the hour is that both gynecologist and psychiatrist work in cooperation to reduce the problems caused by PMDD.

Key words: Cross-sectional, Depression, Dysphoric, Irritability, Premenstrual, Self-esteem

INTRODUCTION

Menstruation is a physiological process. It is the endpoint in the cascade of events starting at the hypothalamus

and ending in the uterus.^[1] Many women complain of premenstrual symptoms, for example, nausea, headache, abdominal distention, and breast tenderness. In most of the cases, symptoms are usually mild and no treatment is required. However, in about 30% cases, the symptoms are severe, known as premenstrual syndrome (PMS). PMS is comparatively a mild condition than a premenstrual dysphoric disorder (PMDD) as the PMS usually not interfere with daily activities, and the symptoms experienced are in mild form. These may be physical symptoms or many emotional symptoms, for example, anxiety, depression, irritability, and lack of concentration. In about 9% of

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women, the symptoms of PMS, cause severe disability and are categorized as PMDD.^[2] PMDD is hormone-based mood disorder causing severe and debilitating form of PMS. Probably the women with PMDD are more sensitive to normal levels of estrogen and progesterone fluctuation. Certain risk factors have been assigned for this disorder. These risk factors are stress, history of interpersonal trauma, seasonal changes, and heritability. Women using oral contraceptives have less chances of PMDD than women who do not use oral contraceptives. As per study in the American Journal of Psychiatry, PMDD usually occurs in women at about 26 years of age though it may arise at any time during reproductive life. Most women with postmenstrual syndrome are able to perform daily activities without much distress. However, women with PMDD with psychological symptoms are not able to perform their routine daily activities. The psychological symptoms may be anxiety, irritability, depression, tension, and suicidal thoughts. These symptoms are usually present in most of the cycles, but not in all. The symptoms of PMDD start about a week before the start of menstruation and end after the start of the menstruation. To diagnose women suffering from PMDD, the women should have had experienced the symptoms of PMDD in most of the menstrual cycles of the previous year. It is pertinent to tell that the presence of behavioral or physical symptoms in the absence of mood and/or anxious symptoms is not sufficient for diagnosis. In most of the cases, at least five of the following symptoms must be present in PMDD.

- Mood swings (depression, feeling of hopelessness)
- Irritability, anger, increased interpersonal conflicts
- Anxiety, tension
- Loss of interest in routine activities
- Lack of concentration
- Lack of energy
- Change in appetite
- Sleep disturbance
- Sense of being overwhelmed or out of control
- Physical symptoms such as tenderness of breast, swelling of breast, muscle of joint pain, bloating sensation, or weight gain.

Out of these five symptoms, one should be related to mood and it should be severe in nature and other four symptoms should be moderate to severe in nature.

We have to be sure that the symptoms are not a severe form of another disorder such as panic disorder or depression and there is a history of symptomatic cycles.^[3]

The severity of symptoms vary among different women.^[4] In some women, the symptoms are more severe toward menopause. PMDD does not occur during pregnancy and after menopause. The PMDD is quite common problem. It

impairs mental health of the patient. It impairs the quality of life (QOL) of the patients. Patients have difficulty in adjustment and relations. They have disturbed social life. There are studies that work efficiency and productivity are decreased. There is a need to identify this disorder and proper treatment should be done. This will decrease the sufferings of the patients. This will have a bearing on the family life, social life, community life, and economical life of patients.

MATERIALS AND METHODS

A cross-sectional study was done among female nursing staff (of menstrual age) working in the medical college and hospital. The study was conducted from February 2018 to January 2019.

The sample consisted of 150 females having regular menstrual cycles (21–35 days) and willing to give written informed consent was encouraged to participate in the study. Those who did not give written informed consent and those who were having medical and gynecological illnesses such as anemia, diabetes, hypothyroidism, asthma, migraine, epilepsy, pelvic inflammatory diseases (PIDs), endometriosis, and amenorrhea were excluded.

The case record form included socio-demographic data of participants, menstrual history, premenstrual family history of PMS in first degree relatives, and premenstrual symptoms screening tool (PMSST).

PMSST

It is the screening tool developed by Steiner *et al.*, which reflects and “translates” categorical Diagnostic and Statistical Manual Mental Disorder – fourth edition (DSM-IV)-Text Revision (TR) criteria into a rating scale with degrees of severity. It includes 14 items assessing premenstrual symptoms of mood, anxiety, sleep, appetite, and physical symptoms. It also includes functional impairment items of five different domains. Participants rated their experience of each symptom and functional impairment item on four-point Likert scale as “not at all,” “mild,” “moderate,” or “severe” in past 12 months duration during most of the cycles. “PMDD,” “moderate to severe PMS,” and “no/mild PMS” subjects were identified using PSSST scoring criteria.

Rosenberg self-esteem scale (RSES)

Self-esteem is a judgment of oneself or one’s attitude toward himself/herself. It is an overall subjective emotional estimation of one’s worth. The RSES is widely used self-reporting instrument for evaluating self-esteem. It is a 10-item scale; with items to be answered on a four-point scale – from strongly agree to strongly disagree. It uses a scale of 0–30 where a score of <15 may show problematic low

self-esteem. This scale measures the state of self-esteem by asking the participant to rate their current mood, i.e., mood during participants premenstrual phase.

The women's QOL questionnaire (WOMQOL): QOL is a multi-dimensional construct and defined subjectively. The WOMQOL was developed as part of a community-based study of women's health, including mental health through the menstrual cycle with no known pathology. A generic conceptualization of QOL was used in the construction of the measure that weighted health and non-health factors to ensure the representation of the life experiences of a broad range of women in the community-based Women Wellness study. The participants were asked to answer "yes," "no," or "not applicable" to the 40 questions in the WOMQOL based on how they have felt in the last week of their life.

A proper performance was given to each subject. This included socio-economic data and specifically designed questions for the diagnosis of PMDD. The questioner was based on DSM-IV criteria. The subject had to answer "yes" or "no." The subjects were classified according to the presence of symptoms. The presence or absence of depressive symptoms was assessed using Hamilton Depression Rating Scale (HDRS). Out of these 9 items is scored on a scale of 0–2 and others on a scale of 0–4, making the possible score range 0–50. The cutoff score for depression on HDRS was 14.

Ethical considerations

The Institutional Ethics Committee's approval for Research on Human Subjects was taken. Throughout the study, strict ethical norms were maintained. Written informed consent was taken from patient in their local language (mother tongue).

Statistical methods in methodology

The data were collected properly, and entries were made, and statistical analysis was carried out using simple mathematical expressions like percentage. The data were subjected to the appropriate statistical test wherever applicable. Statistical analysis was carried out using statistical SPSS version 23 software.

For diagnosis of PMDD, the criteria listed in the DSM-IV were taken [Table 1]. The subjects were explained the purpose of the study and a brief summary of PMDD was told. Some subjects refused as they felt embraced.

RESULTS

This cross-sectional study was conducted on female nursing staff (of menstrual age) working in the medical college and hospital. The study was conducted from February 2018 to

January 2019. The study was conducted on 150 females. Those who were having medical and gynecological illnesses such as anemia, diabetes, hypothyroidism, asthma, migraine, epilepsy, PIDs, endometriosis, and amenorrhea were excluded from the study.

The subjects were of age ranging from 21 to 40 years with mean age 32.8 years. Height ranged from 1.55 to 1.74 m with a mean height of 1.59 m. The weight of the subjects varied from 48 to 70 kg with a mean weight of 57.3 kg [Table 2]. The number of days of menstruation of the subjects varied from 4 to 8 days with a mean of 5.8 days. Duration of menstrual cycle ranged from 25 to 34 days with a mean of 28.7 days [Table 3]. The menstruation was normal in frequency in 111 (74%) subjects and there was an increased frequency of menstruation in 39 (26%) subjects [Table 4]. The menstrual flow was normal in 84 (56%), heavy in 42 (28%), and less in 24 (16%) subjects. Pain killer was used in 105 (70%) and not used in 45 (30%) subjects [Table 5]. The most frequent affective symptom was persistent irritability, found in 16 (10.67%) subjects. This was followed by depression, angry outburst, anxiety, inability to concentrate, loss of interest, and sleep disturbance. Most frequent somatic symptom was weakness, followed by breast tenderness, lethargy, abdominal bloating, headache, and swelling of extremities [Table 6]. Social life was affected by 28 (18.67%) subjects. There was no effect on social life

Table 1: DSM-IV (Diagnostic and Statistical Manual of Mental Disorder - Fourth Edition) criteria for the diagnosis of PMDD (Premenstrual Dysphoric Disorder)

Characteristic features
Depressed mood, feeling of helplessness or self-depreciation thoughts
Intense anxiety, tension or feeling "pushed to the limit"
Intense affective instability
Anger or severe irritability, or significant increase of personal conflicts
Decrease interest in usual activities
Concentration difficulties
Lethargy, marked fatigue, lack of usual energy
Marked change in appetite, both decrease or increase of appetite
Significant increase or reduction of sleep
Feeling overwhelmed
Physical symptoms, such as headache, muscle or articular pain, weight gain

DSM-IV: Diagnostic and Statistical Manual of Mental Disorder – fourth edition

Table 2: Different characteristics, i.e., age, height, and weight of the subjects

Characteristics	Range	Mean
Age	21–40 years	32.8 years
Height	1.55–1.74 m	1.59 m
Weight	48–70 kg	57.3 kg

Table 3: Menstrual characteristic

Characteristics	Range	Mean
No. of days of menstruation	4–8 days	5.8 days
Duration of cycle	25–34 days	28.7 days

Table 4: Menstrual characteristic continued

Frequency of menstruation	Number of subjects	Percentage (%) of subjects
Normal	111	74%
Increased	39	26%

Table 5: Menstrual characteristics continued

Characteristics	Normal	Heavy	Less
Menstrual flow	84 (56%)	42 (28%)	24 (16%)
Pain killer used	Yes, 105 (70%)	No, 45 (30%)	

Table 6: Symptoms of premenstrual syndrome

Symptoms	n (%)
Persistent irritability	16 (10.67)
Depression	15 (10.00)
Angry outbursts	13 (8.67)
Anxiety	12 (8.00)
Lethargy	24 (16.00)
Weakness	28 (18.67)
Breast tenderness	26 (17.33)
Abdominal Bloating	22 (14.67)
Headache	13 (8.67)
Sleep disturbance	9 (6.00)
Swelling of extremities	8 (5.33)
Loss of interest	10 (6.60)
Inability to concentrate	11 (7.33)

in 122 (81.33%) subjects [Table 7]. As per DSM-IV criteria for the diagnosis of PMDD, in our study out of a total of 150 subjects, 13 suffered from PMDD. Our prevalence rate came out to be 8.67% [Table 8].

DISCUSSION

The purpose of this cross-sectional study of PMDD was to find the extent and severity of the premenopausal symptom and PMDD among nursing staff of tertiary care center in one of the aspirational district of North India.

Premenstrual symptoms occur during the luteal phase of the menstrual cycle. These affect the routine activities and performance of the women. Most of the women suffer from one or more premenstrual symptoms. Usually, no treatment is required.^[5]

As per DSM-IV criteria for the diagnosis of PMDD, it has been found that about 70–75% of women have mild

Table 7: Effects on social life

Effects present/ not present	n (%)
Effects present	28 (18.67)
Effects not present	122 (81.33)

Table 8: Prevalence rate of premenstrual dysphoric disorder in our study

Total number of subjects	Subjects having premenstrual dysphoric disorder	Prevalence rate
150	13	8.67

Table 9: Prevalence rate of premenstrual dysphoric disorder in different study

Studies	Prevalence rate
Rivera-Tovar and Frank ^[8]	4.60
Cohen <i>et al.</i> ^[9]	6.40
Banerjee <i>et al.</i> ^[10]	6.40
Steiner <i>et al.</i> ^[11]	8.30
Tabassum <i>et al.</i> ^[12]	18.20

premenstrual symptoms, about 25–30% have moderate symptoms and 5–10% women have severe symptoms, and as per DSM-IV criteria they fall in PMDD. This has been advocated in studies by Johnson (1987)^[6] and Lolas (1993).^[7] The prevalence rate in our study is 8.67%. The prevalence rate of Rivera-Tovar and Frank (1990)^[8] is 4.6%, Cohen *et al.* (2002)^[9] is 6.4%, Banerjee *et al.* (2000)^[10] is 6.4%, and Steiner *et al.* (2011)^[11] is 8.3%. Tabassum *et al.* (2005)^[12] is 18.2% [Table 9]. In these studies, mostly the prevalence rate is 4.6–8.3%. Our study has shown a higher prevalence rate, which may be due to lack of awareness preventing the patients to get treatment benefits.

So far, etiology is concerned, many factors such as psychologic, biologic, social factors, genetic factors, and environmental factors play a part. Hormone imbalances, vitamin deficiency, imbalance of estrogen and progesterone, imbalances of neurotransmitters and retention of sodium, all have been implicated.

So far, as treatment is concerned, to reduce symptoms and improve the quality of social and occupational health. For these two aims, we have found that the changes in lifestyle are very valuable. Regular exercise, decrease coffee intake (will decrease anxiety and irritability), and decrease in sodium intake, which will reduce edema and bloating. Alcohol should be restricted. Regular sleep should be taken, and regular small frequent balanced meals should be taken. Vitamin, calcium, magnesium, and tryptophan supplement

should be taken. The patient should be counseled about the cause, diagnosis, and the treatment of this condition. The training which will reduce stress, manage anger, and interpersonal conflicts should be given by the psychiatrists. Cognitive behavioral should be given to the women having negative thoughts. Alprazolam and/or symptomatic focused therapy may be given. In selected cases, GnRH agonist or danazol for two or three cycles may be given. These women with premenopausal syndrome or premenopausal dysphoric disorder suffer from severe social and family issues, and if due care is taken there, problem will subside. Moreover, their QOL and efficiency at workplace will improve and they will get rid of their symptoms.

CONCLUSION

The study of PMDD is highly useful because it makes us realize that the suffering of women having PMDD is genuine and we cannot ignore these symptoms. We have to be very considerate to them and all modalities of treatment should be given to relieve the women of their sufferings and to reduce the physical and psychological distress. The purpose of this study is to reduce symptoms and improve the quality of women's social and occupational health. Their QOL and work efficiency will increase with proper guidance and treatment, and their self-esteem will be high. More research should be conducted. The need of the hour is that both gynecologist and psychiatrist work in cooperation to reduce the problems caused by PMDD.

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Transcranial Ultrasound in Evaluation of Hypoxic-Ischemic Encephalopathy and Bleed in Preterm Neonates

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Abstract

Aims and Objectives: The aim of the study was to study ultrasound feature of hypoxic-ischemic encephalopathy (HIE) and intracranial hemorrhage.

Materials and Methods: It was a non-interventional prospective cross-sectional observational study done over a period of 1.5 years in the Department of Radiodiagnosis of Seth Gordhandas Sunderdas Medical College and King Edward Memorial Hospital.

Results: A total of 66 cases were evaluated during the study. There were a total of 36 male (54.5%) and 30 female (45.5%) neonates. The difference between a number of males and females was not found to be statistically significant. About 69.7% of the neonates were in the category of very low birth weight (LBW), which was significantly higher than that of LBW ($P < 0001$). In cases of intracranial bleed, the sensitivity and specificity of transcranial ultrasound were found to be 88.89% and 95.83%, respectively, with a diagnostic accuracy of 93.94%. The mean gestational age in patients with intracranial bleed was 29.83 ± 2.20 weeks. Early gestational age was significantly associated with intracranial bleed in neonates. In cases of HIE, the sensitivity and specificity of transcranial ultrasound were 83.33% and 92.59%, respectively, with a diagnostic accuracy of 90.91%. Prevalence of preeclampsia in the mother was highest among the preterm neonates, which suggest that preeclampsia is a significant risk factor for prematurity. The proportion of cases that had vaginal delivery was significantly higher than that of those born through lower segment cesarean section (LSCS) in preterm neonates. The neonatal risk factors that were found to be significantly associated with intracranial bleed and hypoxic encephalopathy were LBW, prematurity, and Apgar score is <6 at 1 min and 5 min after birth. Preeclampsia and intrauterine growth restriction were found to be important maternal risk factors for intracranial bleed in preterm neonates. Preeclampsia and LSCS as the mode of delivery were observed to be important maternal risk factors for HIE in preterm neonates.

Conclusion: Although the sensitivity and specificity of transcranial ultrasonography (USG) are less than that of magnetic resonance imaging, (which is the gold standard in detecting HIE and intracranial bleed in preterm neonates) considering its sensitivity and specificity it can be still considered as the first-line imaging modality of choice for screening preterm neonates for HIE and intracranial bleed. Transcranial ultrasound can, therefore, be used as a routine screening imaging modality for preterm neonates born before 37 weeks of gestational age. The ideal timing for first transcranial USG is on day 3 of life. Follow-up scans should be done on days 7, 14, and 30 to detect persistently abnormal periventricular echogenicity, and cystic changes in HIE. In intracranial bleed follow-up, scans are needed to detect the resolution or progression of hemorrhage and ventricular enlargement.

Key words: Hypoxic-ischemic encephalopathy, Intracranial hemorrhage, Transcranial ultrasound

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INTRODUCTION

Hypoxic-ischemic injury in preterm neonates remains a catastrophic condition causing substantial mortality and morbidity.^[1] It is an important cause of permanent central nervous system (CNS) damage or cerebral palsy and mental deficiency. Different modalities used to detect

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hypoxic-ischemic encephalopathy (HIE) and intracranial hemorrhage^[2] are transcranial ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).

Transcranial ultrasound has the advantage of easy availability, being radiation free, bedside, low cost, suitable for screening, and follow-up. MRI has advantage of superior soft tissue contrast differentiation and locates exact size, extent, site of brain injury and its disadvantages are high cost, requirement of transportation/mobilization of sick neonates and being time consuming. CT has the disadvantage of radiation exposure.^[3]

We aimed to detect typical ultrasound findings on transcranial ultrasound of HIE and intracranial hemorrhage and to evaluate the role of ultrasound in the diagnosis of HIE and intracranial hemorrhage in preterm neonates.^[4]

Aims and Objectives

The objectives are as follows:

1. To study ultrasound characteristics of HIE and intracranial hemorrhage, i.e. periventricular

leukomalacia, periventricular cyst, germinal matrix hemorrhage (GMH), intraventricular hemorrhage (IVH), intra parenchymal hemorrhage (IPH), and ventricular dilatation

2. To evaluate the sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of transcranial ultrasound for hypoxic-ischemic encephalopathy and intracranial hemorrhage in preterm neonate as isolated parameters in comparison to clinical diagnosis.

MATERIALS AND METHODS

It was a non-interventional prospective cross-sectional observational study conducted over a period of 1.5 years in the Department of Radiodiagnosis of Seth Gordhandas Sunderdas Medical College and King Edward Memorial (KEM) Hospital. A total of 66 cases were evaluated during the study.

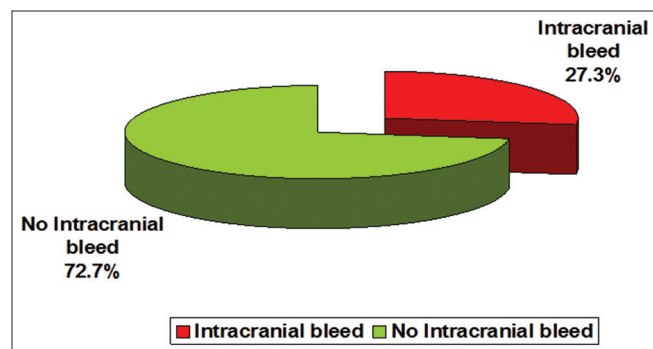


Figure 1: Pie diagram showing distribution of ultrasound findings in patients of intracranial hemorrhage

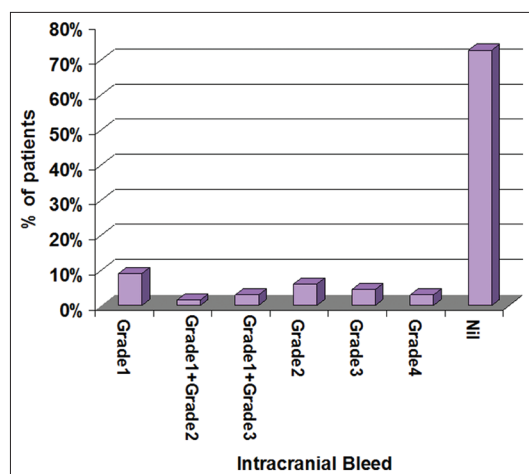


Figure 2: Bar diagram showing distribution of grades in patients of intracranial hemorrhage

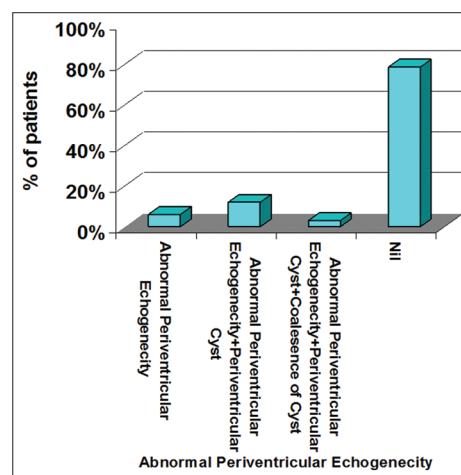


Figure 3: Bar diagram showing distribution of ultrasonography findings in hypoxic-ischemic encephalopathy patients

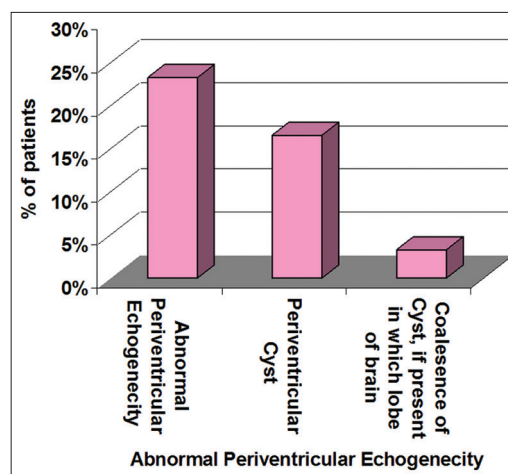


Figure 4: Bar diagram showing distribution of ultrasound findings of hypoxic-ischemic encephalopathy patients

Inclusion Criteria

The following criteria were included in the study:

1. Preterm neonates <37 weeks of gestation age admitted in our hospital NICU
2. Patients having registration at this institute
3. Clinically suspected HIE and intracranial bleed.

Exclusion Criteria

The following criteria were excluded from the study:

1. Parents or guardians being unwilling to give consent for the study
2. All suspected cases of congenital malformation, severe infection, and failed resuscitation.

Study Procedure

All patients were scanned on Philips HD 11XE machine using a 5–12 MHz linear transducer and high-frequency transducer. For all preterm neonates <37 weeks transcranial ultrasound scans were done on 7th, 14th, and 30th days of life through anterior (sagittal, parasagittal, and coronal view) posterior and mastoid fontanel. The examination procedure was explained to the parents/guardian. With the neonate lying in the supine position, ultrasound gel (warmed to room temperature) was spread over the

anterior, posterior, and mastoid fontanel. The transducer, held in the examiner's hand was moved across the anterior, posterior and mastoid fontanel to study neonate brain in sagittal, parasagittal, axial, and coronal planes, until the requisite structures were studied.^[5]

The following parameters were evaluated:

- For intracranial hemorrhage
 1. Germinal matrix hemorrhage
 2. IVH
 3. IPH
 4. Ventricular dilatation.
- For HIE
 1. Abnormal periventricular echogenicity
 2. Periventricular cyst small and large
 3. Cystic lesion in subcortical brain.
- Obstetric history
 1. Type of delivery (vaginal or lower segment cesarean section [LSCS])
 2. Presence of any obstetric complications (e.g., abruptio placentae, placenta previa, preeclampsia, intrauterine growth restriction [IUGR], and infection).

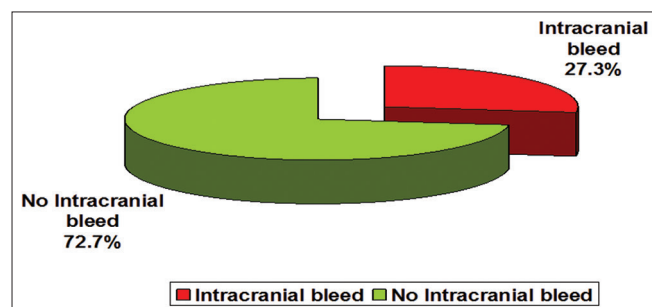


Figure 5: Pie diagram showing the distribution of the patients in clinically diagnosed intracranial hemorrhage

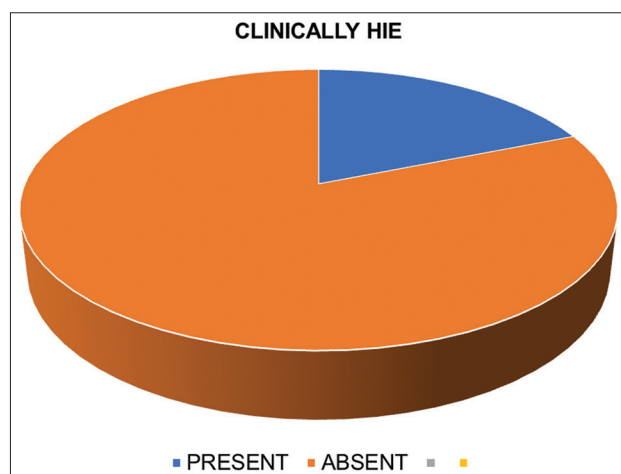


Figure 6: Pie diagram distribution of patients clinically having hypoxic-ischemic encephalopathy

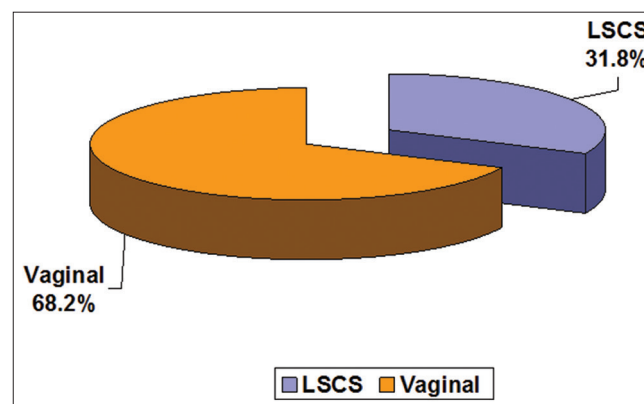


Figure 7: Pie diagram showing the distribution of mode of delivery in the neonates

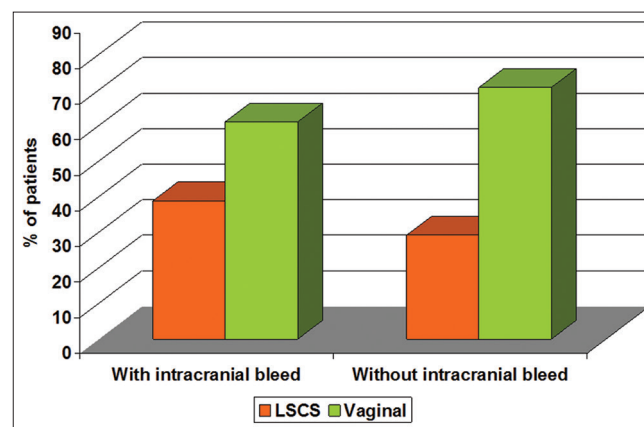


Figure 8: Bar diagram showing the mode of delivery in patients with intracranial hemorrhage

- Neonatal history
 1. 1 min Apgar score
 2. 5 min Apgar score
 3. Neonatal sepsis
 4. Age and sex
 5. Weight at birth.

Statistical Analysis

Using this basic cross-tabulation, software inferences and associations were performed. To test the association of different study variables, Chi-square test was used. When Chi-square was not applicable, Fisher exact test was used.

Table 1: Distribution of ultrasound findings in patients of intracranial hemorrhage

Findings of intracranial hemorrhage	n (%)
Intracranial hemorrhage	18 (27.3)
No intracranial hemorrhage	48 (72.7)
Total	66 (100.0)

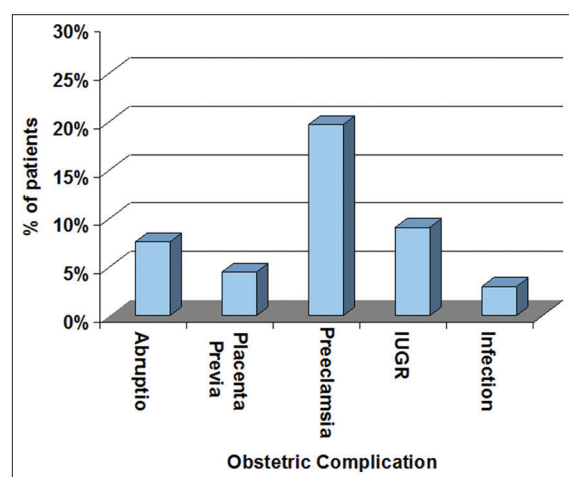


Figure 9: Bar diagram showing the distribution of obstetric complication in neonates

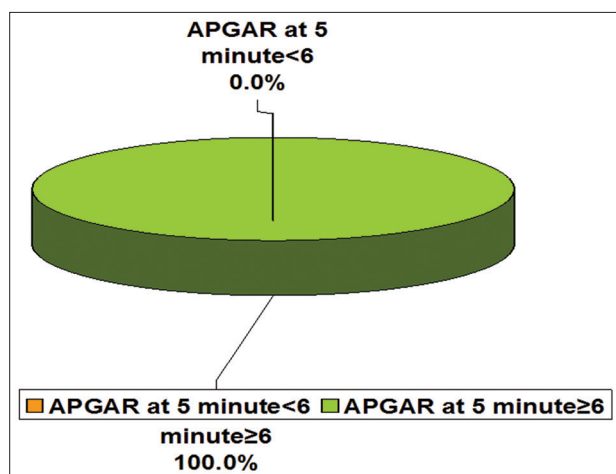


Figure 10: Pie diagram showing distribution of Apgar score at 5 min in the neonates

To test the significance of the difference between two proportions, Z-test (standard normal deviate) was used.

T-test was used to compare the means. Diagnostic accuracy, sensitivity, specificity, positive predictive value, and negative predictive value were calculated to compare the findings of different diagnostic tools. The odds ratio was calculated to find the risk factors with 95% confidence interval. $P < 0.05$ was considered to be statistically significant.

Statistical Software

Statistical analysis was performed with help of Epi Info (TM) 7.2.2.2. Epi Info is a trademark of the Centers for Disease Control and Prevention.

RESULTS

Diagnostic Findings based on Findings of Ultrasonography (USG)

Intracranial hemorrhage was found in 18 (27.3%) of the patients. Thus, the prevalence of intracranial hemorrhage was 27.3%.

No intracranial hemorrhage was found in 48 (72.7%) of the patients ($Z = 9.14$; $P < 0.001$). About 18 (27.3%) of

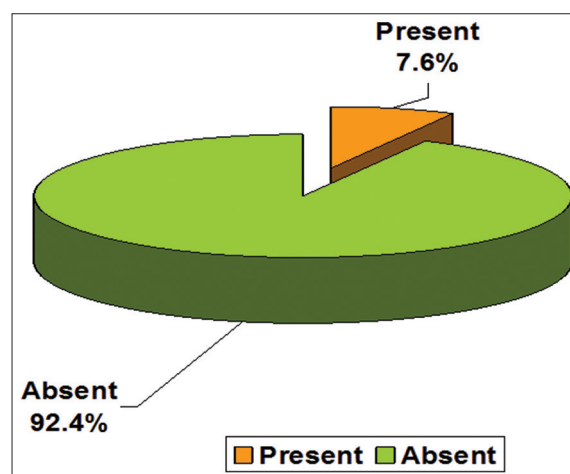


Figure 11: Pie diagram showing distribution of neonatal sepsis in neonates

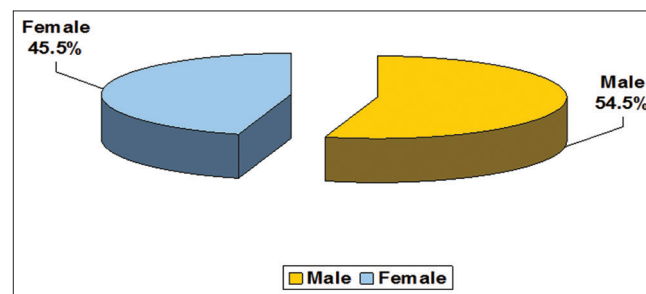


Figure 12: Pie diagram showing distribution of gender in the neonates

the patients that had hemorrhage. Thus, the prevalence of intracranial hemorrhage was 27.3% out of which Grade-I hemorrhage was highest in proportion (13.6%).

No abnormal periventricular echogenicity was found in 78.8% of the patients ($Z = 9.47$; $P < 0.001$). About 14 (23.3%) patients had abnormal periventricular

echogenicity. Ten patients had periventricular cyst and 2 patients had coalescence of cysts.

The presence of abnormal periventricular echogenicity with periventricular cyst was in the highest proportion (23.3%) followed by periventricular cyst (16.6%). Only 2 (3.03%) of the patients had coalescence of the cyst.

Table 2: Distribution of grade in patients of intracranial hemorrhage

Intracranial hemorrhage	n (%)
Grade1	6 (9.1)
Grade1+Grade2	2 (3.1)
Grade1+Grade 3	1 (1.5)
Grade 2	4 (6.1)
Grade 3	3 (4.5)
Grade 4	2 (3.1)
Nil	48 (72.7)
Total	66 (100.0)

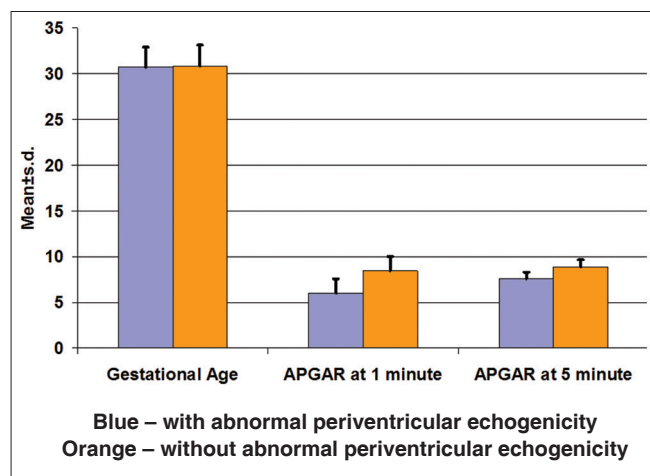


Figure 13: Bar diagram showing the distribution of gestational age, and Apgar score at 1 and 5 min in neonates with respect to abnormal periventricular echogenicity

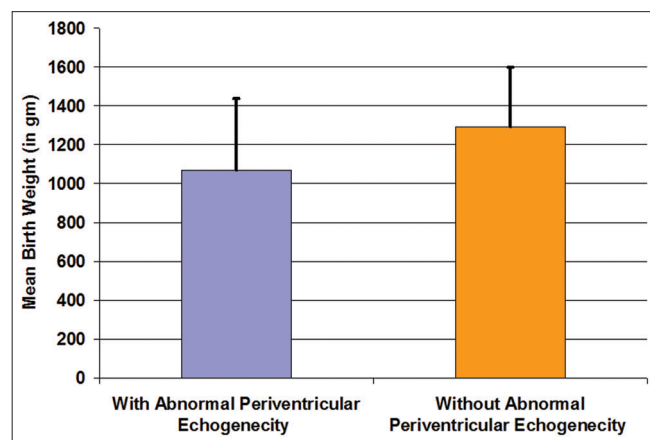


Figure 14: Bar diagram showing the distribution of birth weight in patients with respect to abnormal periventricular echogenicity

Diagnostic Findings based on Clinical Findings

As per the clinical diagnosis, intracranial hemorrhage was found in 18 (27.3%) of the patients.

As per clinical diagnosis, 18.9% of the patients had abnormal periventricular echogenicity. However, most of the patients had no abnormality (81.1%) ($P < 0.001$).

Proportion of vaginal delivery (68.2%) was significantly higher than that of LSCS (31.8%) ($Z = 5.14$; $P < 0.0001$).

Chi-square test showed that there was no significant association between the mode of delivery and intracranial

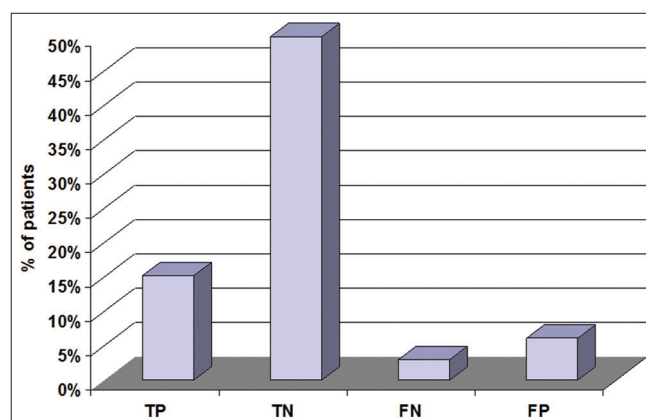


Figure 15: Bar diagram showing percentage of patients with true positive, true negative, false positive, and false negative test in diagnosing hypoxic-ischemic encephalopathy

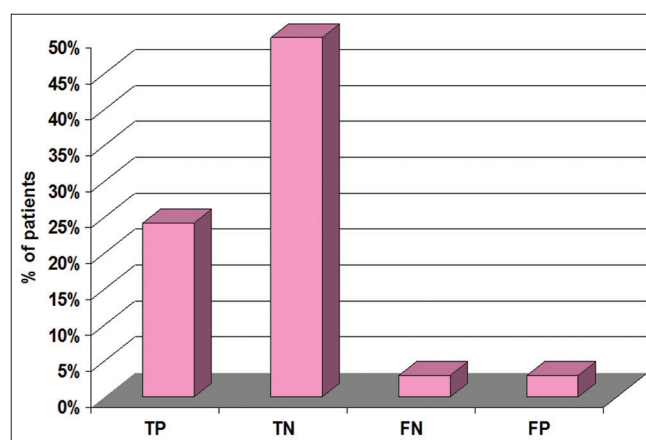


Figure 16: Bar diagram showing the percentage of neonates with true positive, true negative, false positive and false negative test in diagnosing intracranial hemorrhage

Table 3: Distribution of abnormal periventricular echogenicity in the patients of HIE

Abnormal periventricular echogenicity	n (%)
Only abnormal periventricular echogenicity	4 (6.1)
Abnormal periventricular echogenicity+periventricular cyst	8 (12.1)
Abnormal periventricular echogenicity+periventricular cyst+coalescence of cyst	2 (3.0)
Nil	52 (78.8)
Total	66 (100.0)

HIE: Hypoxic-ischemic encephalopathy

Table 4: Distribution of ultrasound findings of HIE patients (n=60)

Abnormal periventricular echogenicity	n (%)
Abnormal periventricular echogenicity	14 (23.3)
Periventricular cyst	10 (16.6)
Coalescence of cysts	2 (3.3)

HIE: Hypoxic-ischemic encephalopathy

Table 5: Distribution of the patients in clinically diagnosed intracranial hemorrhage

Findings based on clinical findings	n (%)
Intracranial hemorrhage	18 (27.3)
No intracranial hemorrhage	48 (72.7)
Total	66 (100.0)

Table 6: Distribution of HIE patients as per the clinical diagnosis (n=60)

Hypoxic-ischemic encephalopathy	n (%)
Present	12 (18.9)
Absent	54 (81.1)
Total	66 (100.0)

Table 7: Distribution of mode of delivery in neonates

Mode of delivery	n (%)
LSCS	21 (31.8)
Vaginal	45 (68.2)
Total	66 (100.0)

hemorrhage in the patients of this study ($P = 0.45$). However, the proportion of LSCS was higher among the patients with intracranial hemorrhage (38.9%) as compared to the patients without intracranial hemorrhage (29.2%), but it was not significant ($Z = 1.44$; $P = 0.26$).

The risk of LSCS was 1.54 times more among the patients with intracranial hemorrhage as compared to the patients without intracranial hemorrhage but the risk was not significant (OR-1.54 [0.49, 4.80]; $P = 0.45$).

Table 8: Mode of delivery in patients with intracranial hemorrhage

Mode of delivery	With intracranial hemorrhage (n=18)	Without intracranial hemorrhage (n=48)	Total
LSCS	7	14	21
Row %	33.3	66.7	100.0
Col. %	38.9	29.2	31.8
Vaginal	11	34	45
Row %	24.4	75.6	100.0
Col. %	61.1	70.8	68.2
Total	18	48	66
Row %	27.3	72.7	100.0
Col. %	100.0	100.0	100.0

 $\chi^2=0.57$; $P=0.45$. NS: Not significant**Table 9: Distribution of obstetric complication in neonates (n=60)**

Obstetric complication	n (%)
Abruptio	5 (7.6)
Placenta previa	3 (4.5)
Preeclampsia	13 (19.7)
IUGR	6 (9.1)
Infection	2 (3.0)

Table 10: Distribution of Apgar score at 5 min in the neonates

Apgar score at 5 min	Number	Percentage
<6	0	0.0
≥6	66	100.0
Total	66	100.0
Mean±SD	8.61±0.89	
Median	9	
Range	6–10	

SD: Standard deviation

Table 11: Distribution of neonatal sepsis in the neonates

Neonatal sepsis	n (%)
Present	5 (7.6)
Absent	61 (92.4)
Total	66 (100.0)

Obstetric Complication

Prevalence of preeclampsia (19.7%) was the significantly highest of all ($Z = 2.13$; $P = 0.042$).

The mean (mean \pm standard deviation) Apgar score at 5 min in the neonates was 8.61 ± 0.89 with range 6–10 and the median was 9.

All the neonates had Apgar score at 5 min ≥ 6 (100.0%) which was significantly higher ($Z = 14.12$; $P < 0.0001$).

About 5 (7.6%) of the neonates had sepsis.

About 54.5% of the neonates were male, which was higher than that of females (45.5%), but it was not significantly higher ($Z = 1.27$; $P = 0.13$) [Figures 1-27 and Tables 1-17].

DISCUSSION

In our study, there were a total of 36 male (54.5%) and 30 female (45.5%) neonates. Total number males were greater than that of females. However, it was not significantly higher statistically ($P = 0.13$).

In our study, the mean birth weight of neonates was 1244.62 g with a standard deviation of 333.2 g. About 69.7% of the neonates were in the category of very low birth weight (VLBW), which was significantly higher than that of LBW ($P < 0.001$).

Table 12: Distribution of gender in the neonates

Gender	n (%)
Male	36 (54.5)
Female	30 (45.5)
Total	66 (100.0)

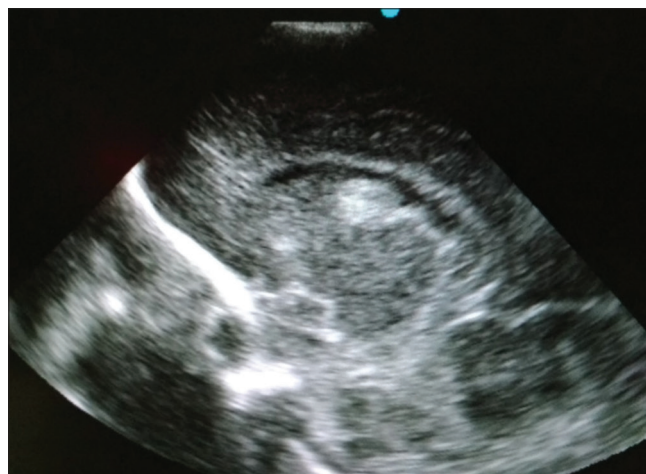


Figure 17: Sagittal section of brain showing Grade 1 germinal matrix hemorrhage



Figure 18: Coronal view of brain showing Grade I germinal matrix hemorrhage on both side

The mean gestational age of the neonates in our study was 30.6 weeks with a standard deviation of 2.35 weeks, with range 27–35 weeks and median was 30 weeks.

In our study, proportional of vaginal delivery (68.2%) was significantly higher than that of LSCS (31.8%) ($P < 0.0001$).

The mean Apgar score at 1 min was 7.92 with standard deviation of 1.64, with range of 4–10. The median Apgar score at 1 min was 9. Most the neonate had Apgar score at 1 min >6 (86.4) which was significantly higher than score <6 .

The mean Apgar score at 5 min was 8.61 with standard deviation of 0.89, with range of 6–10. The median Apgar score at 5 min was 9.

About 13 patients (19.7%) had preeclampsia as an obstetric complication, followed by IUGR (6 patients, 9.1%), abruption (5 patients, 7.6%), placenta previa (3 patients,



Figure 19: Coronal view of brain showing Grade II germinal matrix hemorrhage



Figure 20: Coronal view of brain showing resolving Grade III germinal matrix hemorrhage

Table 13: Distribution of obstetric complications in neonates with respect to intracranial hemorrhage

Obstetric complication	With intracranial hemorrhage (n=18)	Without intracranial hemorrhage (n=48)	χ^2 -test P-value	OR
	n (%)	n (%)		
Abruptio	2 (11.1)	3 (6.3)	$\chi^2=0.44$ $P=0.50$ NS	OR-1.87 (0.28, 12.26) $P=0.50$
Placenta previa	2 (11.1)	1 (2.1)	$\chi^2=2.45$ $P=0.11$ NS	OR-5.87 (0.49, 69.22) $P=0.11$
Preeclampsia	4 (22.2)	9 (18.8)	$\chi^2=5.14$ $P=0.024^*$	OR-1.23 (1.03, 4.66) $P=0.024$
IUGR	4 (22.2)	2 (4.2)	$\chi^2=5.16$ $P=0.023^*$	OR-6.57 (1.08, 39.87) $P=0.023$
Infection	1 (5.6)	1 (2.1)	$\chi^2=0.53$ $P=0.46$ NS	OR-2.76 (0.16, 47.06) $P=0.46$
Neonatal Sepsis	1 (5.6)	4 (8.3)	$\chi^2=0.14$ $P=0.70$ NS	OR-0.64 (0.06, 6.21) $P=0.70$
Gender of neonates (male: female)	12:6 (66.7:33.36)	24:24 (50.0:50.0)	$\chi^2=1.46$ $P=0.22$ NS	OR-2.00 (0.64, 6.20) $P=0.22$
LBW: VLBW	3:15 (16.7:83.3)	17:31 (35.4:64.6)	$\chi^2=4.17$ $P=0.03$ NS	OR-3.36 (1.03, 6.44) $P=0.03$

*Statistically significant, NS: Statistically not significant, VLBW: Very low birth weight, OR: Odds ratio, LBW: Low birth weight, IUGR: Intrauterine growth restriction



Figure 21: Sagittal view of brain showing Grade III germinal matrix hemorrhage and Grade III periventricular leukomalacia

4.5%), and infection (2 patients, 3%). About 5 (7.6%) of the neonates had sepsis.

Prevalence of preeclampsia (19.7%) was the significantly highest of all.

Intracranial Hemorrhage

Out of 66 patients, total 18 patients had ultrasound findings of intracranial bleed. Out of which Grade I was in highest proportion (13.6%).^[6] Two patients had Grade IV bleed which had lowest proportion (3%). Total 9 patients had Grade I intracranial hemorrhage, 6 patients had Grade II intracranial hemorrhage, 4 patients had Grade III intracranial hemorrhage, 2 patients had Grade IV intracranial hemorrhage, 2 patients had Grade I and II intracranial hemorrhage, and 1 patient had Grade I and III intracranial hemorrhage.



Figure 22: Coronal view showing Grade IV intraparenchymal hemorrhage

On comparing the ultrasound findings with clinical diagnosis for diagnosing intracranial bleed in preterm neonates, the sensitivity was 88.89% and specificity was 95.83%. The diagnostic accuracy of the test was 93.94%.

According to Babcock and Han, sensitivity and specificity of USG for intracranial hemorrhage were 95% and 100%, respectively.^[7]

The mean gestational age in patients with intracranial bleed was 29.83 ± 2.20 weeks. Early gestational age was significantly associated with intracranial bleed in neonates.

Twelfth male and 6 female preterm neonates had finding of intracranial bleed. Proportion of male in respect to female was high; however, there was no significant correlation.



Figure 23: Coronal view showing resolving Grade I germinal matrix hemorrhage on right side

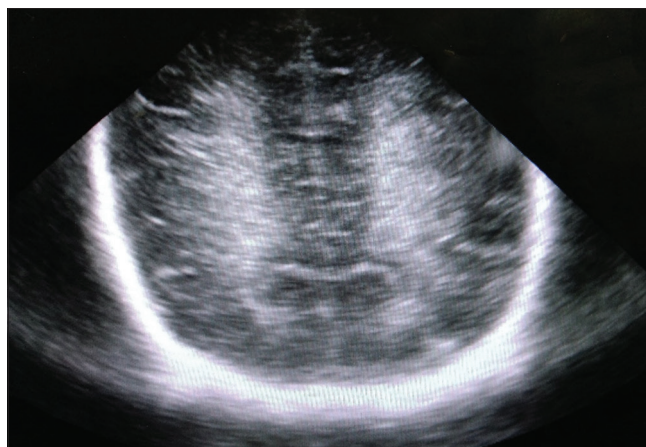


Figure 25: Coronal view of brain showing abnormal periventricular echogenicity

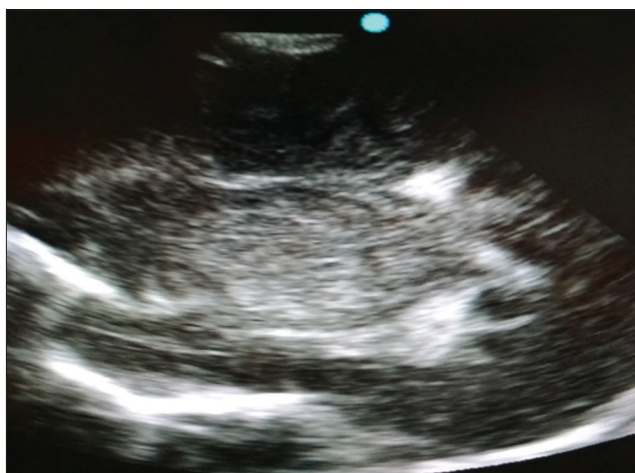


Figure 24: Parasagittal view of brain showing abnormal periventricular echogenicity



Figure 26: Sagittal view showing Grade IV periventricular leukomalacia

Seven patients had LSCS mode of delivery and 11 patients had vaginal mode of delivery. There was no significant association between mode of delivery and intracranial bleed in preterm neonates.

The mean Apgar score of preterm neonates with intracranial bleed at 1 min and 5 min was 7.05 ± 1.62 and 8.22 ± 0.74 , respectively, which was statistically significant.

The mean birth weight of preterm neonates with intracranial bleed was 1138.11 ± 369 g. There were 3 preterm neonates with LBW and 15 neonates had VLBW. There was significant association of preterm neonate of LBW and VLBW with intracranial bleed.

In this study out of 18 patients of intracranial bleed, 4 patients were associated with preeclampsia and another 4 patients were associated with intrauterine growth

retardation. The association of intracranial bleed in preterm neonate with preeclampsia and IUGR was significant.

Thus, there was a significant association of intracranial bleed in preterm neonates with early gestational age, low Apgar score at 1 min and 5 min, LBW, preeclampsia and IUGR as maternal complication.^[8]

HIE

Out of 66 patients, total 14 (prevalence-12.1%) patients had ultrasound findings of HIE. Out of which abnormal periventricular echogenicity was present in all 14 patients, 10 patients had abnormal periventricular echogenicity with small periventricular cysts, 2 patients had all three changes of HIE, i.e. abnormal periventricular echogenicity, small periventricular cyst with coalescence to form large cyst.^[9]

On comparing the ultrasound findings with the clinical diagnosis for identifying HIE in preterm neonates, the sensitivity was 83.33% and specificity was 92.59%. The

Table 14: Distribution of gestational age, Apgar score at 1 and 5 min and birth weight in neonates with respect to abnormal periventricular echogenicity

Parameter (mean±SD)	With abnormal periventricular echogenicity (n=14)	Without abnormal periventricular echogenicity (n=52)	t-test (t_{64})	P-value
Gestational age	30.7±2.22	30.84±2.29	2.73	<0.001*
Apgar at 1 min	6.00±1.57	8.44±1.57	6.23	<0.0001*
Apgar at 5 min	7.57±0.72	8.88±0.77	5.85	<0.0001*
Birth weight (in g)	1069.13±368.61	1291.73±306.11	2.55	0.017*

*Statistically significant. SD: Standard deviation

Table 15: Distribution of obstetric complications and abnormal periventricular echogenicity of the patients

Obstetric complication	With abnormal periventricular echogenicity (n=14)	Without abnormal periventricular echogenicity (n=52)	χ^2 -test P-value	OR
	n (%)	n (%)		
Abruptio	2 (14.3)	3 (5.8)	$\chi^2=1.14$ $P=0.28$ NS	OR-[2.72 (0.40, 18.15)] $P=0.28$
Placenta Previa	0 (0.0)	3 (5.8)	Fisher exact test $P=0.48$ NS	NA
Preeclampsia	8 (57.1)	5 (9.6)	$\chi^2=15.75$ $P<0.0001$ *	OR-[12.53 (3.07, 51.01)] $P<0.0001$
IUGR	2 (14.3)	4 (7.7)	$\chi^2=0.58$ $P=0.44$ NS	OR-[2.00 (0.32, 12.23)] $P=0.44$
Infection	1 (7.1)	1 (1.9)	$\chi^2=1.02$ $P=0.31$ NS	OR-[3.92 (0.22, 67.01)] $P=0.31$
Neonatal Sepsis	2 (14.3)	3 (5.8)	$\chi^2=1.14$ $P=0.28$ NS	OR-[2.72 (0.40, 18.15)] $P=0.28$
Gender of neonates (male: female)	9:5 (64.3:35.7)	27:25 (51.9:48.1)	$\chi^2=0.67$ $P=0.40$ NS	OR-[1.66 (0.49, 5.65)] $P=0.40$
LBW: VLBW	1:13 (7.1:92.9)	19:33 (36.5:63.5)	$\chi^2=4.51$ $P=0.033$ *	OR-[1.36 (1.09, 2.44)] $P=0.033$

*Statistically significant, NS: Statistically not significant, VLBW: Very low birth weight, LBW: Low birth weight, IUGR: Intrauterine growth restriction

diagnostic accuracy of the test was 90.91%. In the study conducted by Shen *et al.*, the sensitivity and specificity for detecting HIE by USG were 90% and 75%, respectively.^[10]

A systemic review by van Laerhoven *et al.*, T1/T2 changes in neonatal brain MRI had a sensitivity of 98% and specificity of 76%. However, diffusion-weighted MRI changes had a sensitivity of 58% and specificity of 89%, respectively. Thus, MRI has a sensitivity of up to 98% and specificity up to 89%.^[11]

The mean gestational age in patients with HIE was 30.7 ± 2.22 weeks. In preterm neonates with HIE, early gestational age at delivery was statistically significant.

Nine patients had LSCS as the mode of delivery and 5 patients had a vaginal mode of delivery. The proportion of LSCS was significantly higher among patients with abnormal periventricular echogenicity (64.3%) as compared to that of the patients without abnormal periventricular echogenicity. This finding was consistent with the study by Itoo *et al.* that LSCS being the mode of delivery was a risk factor of HIE.^[12]

**Figure 27: Coronal view of brain showing Grade III periventricular leukomalacia**

Nine male and 5 female preterm neonates had finding of HIE. The proportion of males with respect to female was high; however, there was no statistically significant correlation.

The mean Apgar score of preterm neonates with HIE at 1 min and 5 min was 6 ± 1.57 and 7.57 ± 0.72, respectively,

Table 16: Comparison of ultrasonography findings and clinical diagnosis to diagnose hypoxic-ischemic encephalopathy in neonates

Comparison	n (%)
TP	10 (15.2)
TN	50 (75.8)
FN	2 (3.0)
FP	4 (6.1)
Total	66 (100.0)

TP: True positive, TN: True negative, FN: False negative, FP: False positive.
 Diagnostic accuracy = $(TP+TN)/\text{total cases} \times 100 = 90.91\%$, sensitivity = $TP/(TP+FN) \times 100 = 83.33\%$, specificity = $TN/(TN+FP) \times 100 = 92.59\%$, positive predictive value = $TP/(TP+FP) \times 100 = 71.43\%$, negative predictive value = $TN/(TN+FN) \times 100 = 96.15\%$

Table 17: Comparison of ultrasonography findings and clinical diagnosis to diagnose intracranial hemorrhage in neonates

Comparison	n (%)
TP	16 (24.2)
TN	46 (69.7)
FN	2 (3.0)
FP	2 (3.0)
Total	66 (100.0)

TP: True positive, TN: True negative, FN: False negative, FP: False positive.
 Diagnostic accuracy = $(TP+TN)/\text{total patients} \times 100 = 93.94\%$, sensitivity = $TP/(TP+FN) \times 100 = 88.89\%$, specificity = $TN/(TN+FP) \times 100 = 95.83\%$, positive predictive value = $TP/(TP+FP) \times 100 = 88.89\%$, negative predictive value = $TN/(TN+FN) \times 100 = 95.83\%$

which was statistically significant. Our findings were consistent with the results of the study done by Ehrenstein which shows that a low Apgar score at 5 min <7 was associated with HIE.^[13]

The mean birth weight of preterm neonates with HIE was 1069.13 ± 368.61 g. There was 1 preterm neonate with LBW and 13 neonates with VLBW. There was a significant association of preterm neonates of LBW and VLBW with HIE. These findings were consistent with the study done by Pálsdóttir *et al.* which had shown that LBW is a significant risk factor for HIE.^[14]

Thus, there was a significant association of HIE in preterm neonates with early gestational age at delivery, low Apgar score at 1 min and 5 min, and LBW.

In this study, out of 14 patients of HIE, 8 patients had associated maternal preeclampsia. There was a strong association of HIE in preterm neonates with preeclampsia in the mother. This finding was consistent with the study done by Badawi *et al.*^[15,16] that HIE is associated with preeclampsia.

In two patients, the intracranial bleed was associated with neonatal sepsis, which was not found to be statistically significant.

SUMMARY AND CONCLUSION

Hypoxic-ischemic injury in preterm neonates is a serious condition with significant morbidity and mortality. It is the important cause of permanent CNS damage resulting in cerebral palsy and mental deficiency. HIE and intracranial bleed are two ends of the spectrum of hypoxic-ischemic events.

The purpose of the study was to identify the ultrasound findings in HIE and intracranial bleed, which would help in grading them accordingly. Although the sensitivity and specificity of transcranial USG are less than that of MRI, (which is the gold standard in detecting HIE and intracranial bleed in preterm neonates) considering its sensitivity and specificity it can still be considered as the first-line imaging modality of choice for screening preterm neonates for HIE and intracranial bleed.

Even though MRI is the gold standard, it has multiple disadvantages such as need for mobilization and cumbersome transportation of sick neonates which are on life supports (CPAP/ventilator), requirement of sedation/general anesthesia, limited availability, and high cost.

In intracranial bleed, the sensitivity and specificity of transcranial ultrasound were found to be 88.89% and 95.83%, respectively, with a diagnostic accuracy of 93.94%. In HIE, the sensitivity and specificity of transcranial ultrasound were found to be 83.33% and 92.59%, respectively, with a diagnostic accuracy of 90.91%.

The proportion of cases that had vaginal delivery was significantly higher than that of those born through LSCS in preterm neonates. Neonatal risk factors that were found to be significantly associated with intracranial bleed and hypoxic encephalopathy were LBW, prematurity, and Apgar score <6 at 1 min and 5 min of birth.

Preeclampsia and IUGR were important maternal risk factors for intracranial bleed in preterm neonates. Preeclampsia and LSCS as a mode of delivery were important maternal risk factors for HIE in preterm neonates. Comparison with long-term neurological outcomes was not possible due to the short duration of our study. Transcranial USG is operator dependent.

Transcranial ultrasound should be used as a routine screening imaging modality for all preterm neonates born before 37 weeks.

Follow-up scan should be done on days 7, 14, and 30 to detect persistent abnormal periventricular echogenicity, and cystic changes in HIE and in intracranial bleed to

detect the resolution or progression of hemorrhage and ventricular enlargement.

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Effect of Lifestyle Variables (Physical Activity, Diet, and Body Mass Index) on the Lipid Profile of Individuals of Kolhan Region

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Abstract

Objective: To study the association between diet, exercise and obesity on the serum lipid profile.

Material and Method: The study was conducted in the department of physiology, MGM medical college and hospital, Jamshedpur. Hundred healthy participants comprised attendants of patient attending OPD of MGM Medical College and healthy volunteers (mainly staff) of the hospital in the age group 30- 50 years. They were observed to see the association between diet, physical activity and BMI on the serum lipid profile.

Conclusion: Body weight was significantly associated with TC, TG and LDL with $P(<0.001)$. There was a partially significant difference in TC, TG and LDL level between sedentary workers and hard workers.

Key words: Body mass index, Total cholesterol, Triglyceride, Low-density cholesterol, Coronary artery disease

INTRODUCTION

A study from the United States in 1991 revealed that almost 60% of American adults had little or no leisure-time physical activity. Regular physical activity has been shown to reduce the coronary artery disease (CAD) risk in multiple epidemiological studies. A daily schedule of 30 min or more of moderately intensive physical activity has been advocated as an effective option to divert CAD risk.^[1] The stress and strain of modern urban life adds to the dearth of physical activity to compound cardiovascular risk.^[2]

It is important to encourage routine and spare time physical activity with the aim of expending at least 300 kcal/day.^[3]

Several trials of the effect of dietary changes on CAD have suggested that altering the fatty acid composition of the diet in favor of greater intake of polyunsaturated fatty acids

and less intake of saturated fats, while restricting the intake of fat calories to <30% of the total calories may lower the risk of subsequent development of CAD.^[4] There is a well-established triangular relationship between habitual diet, blood cholesterol levels, and CAD.^[5]

A vegetarian diet can be strongly cardioprotective, but the Indian vegetarian diet typically has large amount of saturated and trans fat, along with high glycemic carbohydrates and little fish, which has been suggested to be new risk factors of CAD. Diet rich in fish is associated with a decrease in the incidence of atherosclerosis due to the omega fatty acid content of fish.^[6]

Obesity is a chronic condition characterized by an excess body fat. It is a risk factor for several chronic diseases including hypertension, dyslipidemia, diabetes, cardiovascular disease, sleep apnea, osteoarthritis, and some cancers. It is most often defined by body mass index (BMI). The healthy range of BMI is between 18.5 and 24.9; any BMI above this is considered overweight. Another parameter is waist-to-hip ratio (WHR); it provides information about the distribution of body fat. Women should have a WHR of <0.8, while men should have a ratio of 1.0 or less. The fat around your belly can increase your risk for type 2 diabetes and heart disease.^[7]

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Therapeutic Lifestyle Changes in Low Dentistry Lipoprotein (LDL)-Lowering Therapy

ATP III (adult treatment panel III) recommends a multifaceted lifestyle approach to reduce risk for CAD. This approach is designated therapeutic lifestyle changes (TLC). Its essential features are as follows:

- Reduced intake of saturated fats (<7% of total calories) and cholesterol (<200 mg/dl).
- Therapeutic options for lowering LDL such as plant sterols (2g/d) and increased viscous (soluble) fibers (10–25 g/d).
- Weight reductions.
- Increased physical activity.^[8]

MATERIALS AND METHODS

Blood samples were obtained after an overnight fast. About 5 ml of blood was collected from the left antecubital vein. Out of which about 2 ml is transferred into an OF vial and mixed well and centrifuged at a speed of 3000 revolutions/min for 10 min to separate the plasma, which was used for biochemical analysis. Rest 3 ml of blood is transferred to the test tube and this blood was allowed to clot to get serum. This serum was separated in a centrifuge tube at 3000 revolutions/min to get a clear sample of serum. This clear supernatant serum was used for biochemical investigation.

Estimation of Serum Total Cholesterol (TC)

Method – Enzymatic-colorimetric Trinder End point

The reagents were allowed to attain room temperature before use.

Pipette into tube marked	Blank	Standard	Sample
Reagent R	1000 µL	1000 µL	1000 µL
Standard	-	10 µL	-
Sample	-	-	10 µL

They were incubated for 5 min at 37°C and reading was done against blank at 500 nm and calculation was made. The concentration of cholesterol in the sample is directly proportional to the intensity of red complex (red quinone), which was measured at 500 nm.

Calculation

Cholesterol = Absorbance of sample/Absorbance of standard × Concentration of standard

Reference values: <200 mg/dl

Estimation of serum triglyceride (TG) method: Enzymatic-colorimetric method.

Contents were mixed and incubated for 5 min at 37°C. The reading was done against blank at 546 nm.

Pipette into tube marked	Blank	Standard	Sample
Reagent R	1000 µL	1000 µL	1000 µL
Standard	-	10 µL	-
Sample	-	-	10 µL

Calculation

Serum TG = Absorbance of sample/Absorbance of standard × n

n = Standard concentration

Reference values: >150 mg/dl.

Estimation of HDL Cholesterol

Method – Phosphotungstate method.

Principle – Chylomicrons, LDL, and VLDL are precipitated by addition of phosphotungstic acid and magnesium chloride. After centrifugation, the high-density lipoprotein (HDL) fraction remains in the supernatant is determined with CHOD-PAP method.

Reference value: >40mg/dl

Calculation of LDL and VLDL by Friedewald's Formula:

LDL = TC – (HDL + VLDL)

VLDL = TG/5

Reference value

LDL = Up to 190 mg/dl

VLDL = 14–31.8 mg/dl

BMI = Weight (kg)/height² (m²)

WHR = Waist circumference/hip circumference.

Observation

TC, TG, and LDL showed a highly significant upper range in sedentary workers while HDL and VLDL showed partial variations between these two group

Lipid Level Variations among Obese and Non-obese

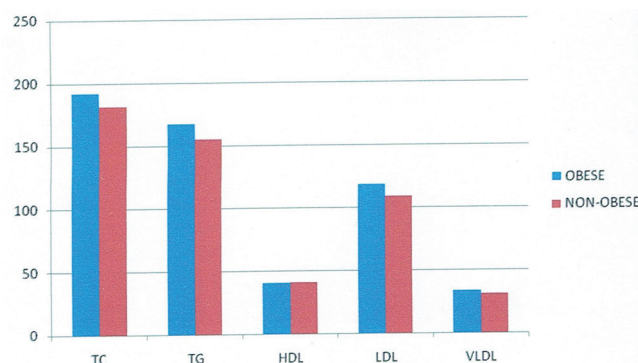
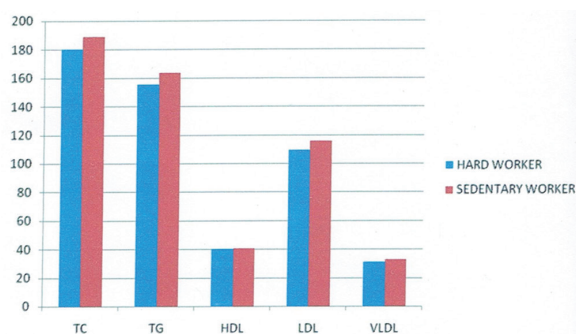


Table 1: Lipid level variations among hard workers and sedentary workers (mean±SD) in mg/dl

	Obese n = 60	Non-obese n= 40	t	P	Significance
Total cholesterol	192.06 ± 17.23	181.49 ± 22.34	3.71	<0.001	HS
Triglyceride	167.07 ± 16.67	155.22 ± 15.80	4.87	<0.001	HS
HDL	40.15 ± 6.61	41.09 ± 6.31	0.97	>0.5	NS
LDL	118.34 ± 18.29	108.88 ± 22.25	3.22	<0.001	HS
VLDL	33.41 ± 3.33	31.04 ± 3.16	1.87	>0.5	NS

Definitely obese had a higher level of total cholesterol, triglyceride and LDL while HDL and VLDL levels were almost equal

Lipid Level Variations among Hard Workers and Sedentary Workers (mean in mg/dl)

Table 2: Lipid level variations among hard workers and sedentary workers (mean±SD) in mg/dl

	Hard worker n = 60	Sedentary worker n = 40	t	p	Significance
Total cholesterol	180.29 ± 18.20	189.13 ± 19.62	1.983	<0.1	PS
Triglyceride	155.14 ± 15.41	163.39 ± 17.56	1.682	<0.1	PS
HDL	40.04 ± 6.56	40.61 ± 6.51	0.52	>0.1	NS
LDL	109.31 ± 20.18	115.84 ± 20.38	1.23	<0.1	PS
VLDL	31.05 ± 3.52	32.68 ± 3.30	0.60	>0.1	NS

Total cholesterol, triglyceride and LDL showed a partially significant higher level in sedentary workers while HDL and VLDL showed no variation between these two groups

DISCUSSION

Our findings provide support for the potentially significant effects of both diet and exercise on the serum lipid profile. The most important lifestyle factors which affect the serum lipid profile are diet composition, body weight, and physical activity. The modifications of blood lipid levels will be beneficial, especially to those who are at higher risk of CAD. Screening for these abnormalities is essential and must be followed by active and effective interventions. Combining campaigns to improve diet with efforts to increase physical activity may be needed to effectively reduce CAD risk.

Nutrient composition of therapeutic lifestyle change diet

Nutrient	Recommended intake
Saturated fat ¹	<7% of total calories
Polyunsaturated fat	Up to 10% of total calories
Monounsaturated fat	Up to 20% of total calories
Total fat	25 and 35% of total calories
Carbohydrate ²	50–60% of total calories
Fiber	20–30 gm/day
Protein	Approximately 15% of total calories
Cholesterol	<200 mg/day
Total calories ³	Balance energy intake and expenditure to maintain desirable body weight/prevent weight gain

¹Transfatty acids are another LDL raising fat that should be kept at a low intake.

²Carbohydrate should be derived predominantly from foods rich in complex carbohydrates including grains, especially whole grains, fruits, and vegetables. ³Daily energy expenditure should include at least moderate physical activity contributing approximately 200 kcal/day

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Comparison of Conjunctival Autograft versus Amniotic Membrane Graft in Primary Pterygium Surgery

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Abstract

Purpose: The purpose of this study is to evaluate and compare the effectiveness of conjunctival autograft transplantation and amniotic membrane graft transplantation in pterygium surgery.

Materials and Methods: This was a randomized, parallel group, Single-center study included 60 patients. 30 patients of which underwent pterygium excision followed by Conjunctival autograft transplantation. The other 30 patients also underwent pterygium excision with amniotic membrane graft transplantation. Follow-up was done for 6 months to evaluate the post-operative complaints, graft integrity, and complications associated with each procedure.

Results: Post-operative discomfort and watering were less in amniotic membrane graft group ($P = 0.13\%$). Further, in amniotic membrane group, there was less transient graft edema ($P = 0.22$) and conjunctival hyperemia ($P = 0.004$). However, graft loss was more ($P = 0.33$) and so was the conjunctival granuloma formation ($P = 0.45$) in the amniotic membrane group.

Conclusion: Amniotic membrane graft is as effective and safe as conjunctival autograft with no major complications.

Key words: Amniotic membrane graft, Conjunctival autograft, Pterygium excision

INTRODUCTION

Pterygium is a degenerative condition of subconjunctival tissues, which proliferates as a vascularized granulation tissue invading cornea, destroying Bowman's layer, and superficial layers of stroma, whole being covered by conjunctival epithelium. Generally, it is asymptomatic except for cosmetic blemish. However, as it advances, it may cause foreign-body sensation, corneal astigmatism, decrease in visual acuity, diplopia, and disturbed tear film stability, causing dryness and punctate keratitis.

Medical treatment has been tried, which includes use of tear substitutes, topical steroids, anti-vascular endothelial growth factor, and ethanol.^[1] Patients may also be advised to wear sunglasses to reduce ultraviolet radiations exposure.

Still, surgical removal remains the treatment of choice with the main challenge of preventing its recurrence. Limbal conjunctival autograft is currently the most popular surgical procedure. Recently, preserved human amniotic membrane has been advocated to reconstruct conjunctival defect after pterygium removal. Amniotic membrane is the innermost layer of the placenta and consists of a thick basement membrane and an avascular stromal matrix. The basement membrane is similar in composition to the conjunctiva and augments support to limbal stem cells and cornea transient amplifying cells. Clonogenicity is maintained which promotes both goblet and non-goblet cell differentiation while excluding inflammatory cells and their protease activities. Furthermore, it suppresses myofibroblast differentiation of normal fibroblasts to reduce scar formation. This action assists healing for conjunctival reconstruction, epithelial defects, and stromal ulceration. It is reasonable to hypothesize that with proper management, amniotic membrane grafts may yield better result in reducing pterygium recurrence.

The aim of this study was to study the efficacy and safety of amniotic membrane graft as adjunctive therapy after

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removal of primary pterygium and to compare the clinical outcome with conjunctival autograft.

MATERIALS AND METHODS

Sixty patients of either sex in the age group of 15–80 years and with primary nasal pterygium [Figure 1] were enrolled in the study. Patients with recurrent pterygium, with ocular surface disorders, or with a history of previous ocular surgery or trauma were excluded from the study. Patients were randomly and equally divided into two groups - Group 1: conjunctival autograft group (30 eyes) and Group 2: amniotic membrane graft group (30 eyes).

A detailed pre-operative assessment including medical and ophthalmic history, visual acuity, digital anterior-segment photography, slit-lamp examination with special reference to type, size, and extent of pterygium, fundoscopy, keratometry, and hematological examination was done.

Informed consent was obtained, and topical instillation of antibiotic with anti-inflammatory eye drops 4 times 1 day before surgery was advised.

Procedure

Pterygium excision was done under peribulbar anesthesia (50:50 mixtures of 5 ml of 2% lignocaine and 5 ml of 0.5% bupivacaine with 150 units/ml of hyaluronidase injection), after proper sterile draping of the eye and placement of universal eye speculum. A small incision was given in the conjunctiva just medial to the head of the pterygium after engaging it with fixation forceps. The conjunctiva was then progressively dissected off from the body of pterygium using Westcott scissors. The pterygium was removed from the cornea by avulsion. The size of defect was measured with the calipers.

In conjunctival autograft group (group 1), ballooning of superotemporal conjunctiva with lignocaine-epinephrine solution and excision of graft using forceps and Westcott scissors were done. The size of graft taken exceeded the bare sclera defect by 1 mm horizontally and vertically. The graft was placed maintaining the original orientation of the juxtalimbal border toward cornea and was smoothed out at its bed. The four corners of graft were anchored, and then, the sides of graft were attached to surrounding conjunctiva at intervals of 1–1.5 mm with interrupted 9–0 sutures [Figure 2].

In amniotic membrane graft group (group 2), the size of commercially available dry amniotic membrane graft [Figure 3] to be taken was determined, and the bare sclera was then covered with it with basement membrane side up.

It was then sutured to the edge of conjunctiva with 7–8 interrupted 9–0 silk suture [Figure 4].

In both groups, antibiotic ointment was applied and the eyes were patched and bandaged for 24 h.

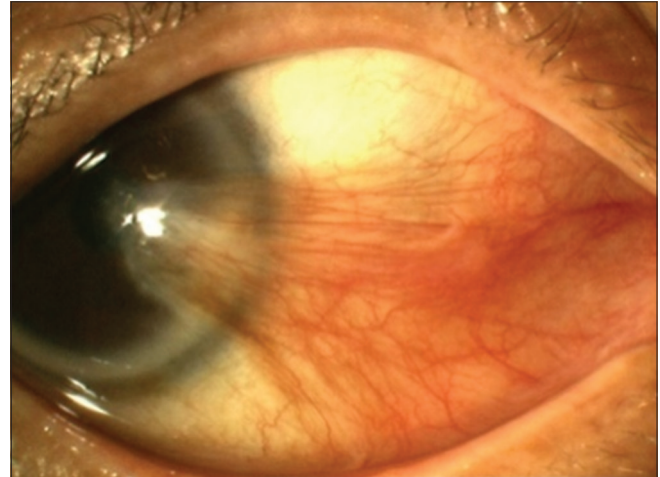


Figure 1: Nasal pterygium encroaching papillary area of the cornea

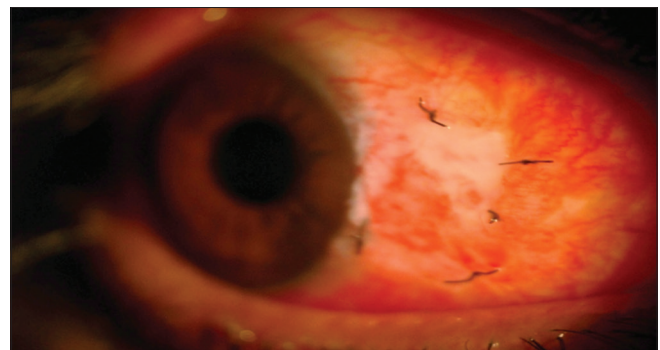


Figure 2: Conjunctival autograft transplantation after pterygium excision



Figure 3: Commercially available dry amniotic membrane graft

After the removal of patch, topical antibiotic and steroid combination (gatifloxacin and prednisolone) eye drop was administered 2 hourly for 2 weeks and tapered over the next 4 weeks. Sutures were removed 2 weeks after surgery.

Follow-up was done on day 1, 7, and 14 at 3 months and at 6 months, and the patients were evaluated for subjective symptoms.

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

Statistics

Eyes rather than people were used as a unit for statistical analysis. Data were presented as mean (standard deviation) or frequency (%). The Chi-square test was done to compare the categorical data between two groups. Recurrence rate was computed by Fisher's exact test.

RESULTS

There was no statistically significant difference regarding sex ($P = 0.09$), age ($P = 0.26$), and laterality ($P = 0.301$) between two groups.

Subjective symptoms of pain, foreign-body sensation, and watering were fewer and disappeared more rapidly in amniotic membrane graft group than that in conjunctival graft group, as shown in Table 1. There was no statistically significant difference between the two groups ($P = 0.13$).

In group 1, i.e., conjunctival autograft group, two patients (7%) had graft loss on the 1st post-operative day, while four patients (13%) in group 2, i.e., amniotic membrane graft group, had graft loss on the 1st post-operative day ($P = 0.33$). Five patients (17%) in group 1 and three patients (10%) in group 2 had graft edema that subsided after the 1st post-operative week ($P = 0.22$). No statistically significant difference was found between two groups.

Table 1: Grade based break-up of patients included in the study

Operative procedure	Number	Watering and post-operative discomfort				Total
		1	2	3	4	
Conjunctival autograft	30	0	18	12	0	30
			60%	40%	0	100%
Amniotic membrane graft	30	0	22	8	0	30
			73%	27%		100%

P value: 0.13

One patient (3%) in the conjunctival autograft group developed recurrence which occurred at 3rd post-operative month. Two cases (7%) in the amniotic membrane graft group developed recurrence which occurred at 3rd and 6th post-operative month, respectively. There was no significant difference in the recurrence rate among the two groups ($P = 0.50$). In group 1 (conjunctival autograft), 20 (67%) patients had conjunctival hyperemia, and in group 2 (amniotic membrane graft), 9 (30%) patients had conjunctival hyperemia which subsided by the end of the 1st post-operative week. There were three cases of conjunctival granuloma [Figure 5] in amniotic membrane graft group and one case in conjunctival autograft group, which were treated surgically. No other complications were seen in both groups.

DISCUSSION

In the present study, the recurrence rate following conjunctival autograft was 3% and the recurrence rate following amniotic membrane graft was 7%. In other studies, Kucukerdonmez *et al.*^[2] described delayed vascularization with amniotic membrane which decreased recurrence rate and Patil and Melmane^[3] showed low recurrence rate with amniotic membrane graft. Another

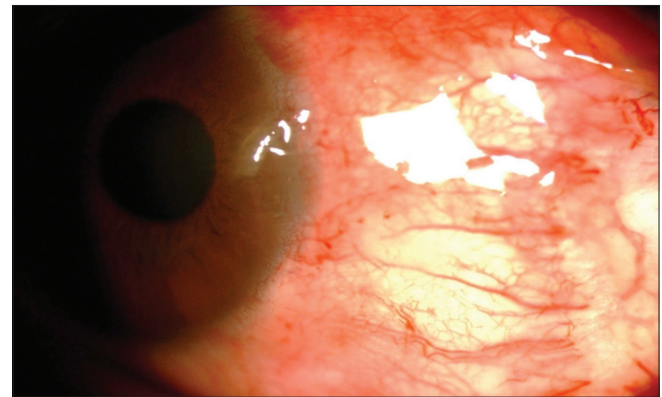


Figure 4: Amniotic membrane graft transplantation after pterygium excision

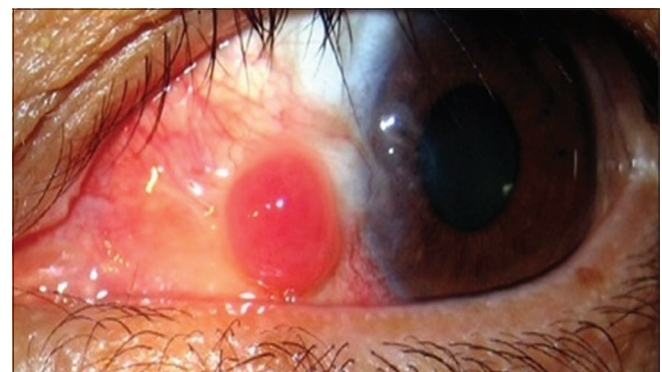


Figure 5: Conjunctival granuloma after pterygium excision

study by Liang *et al.*^[4] showed less recurrence rates with conjunctival autograft group (7.4%) than with amniotic membrane graft group (19.2%). Similar to our study, the recurrence rates were almost double in amniotic membrane group in another study by Clearfield *et al.*^[5]

In the present study, graft edema was present in five eyes in group 1 and three eyes in group 2 which resolved after the 1st post-operative week. Graft loss was present in two eyes in group 1 and four eyes in group 2. Chi-square test was not significant.

A study by Patil and Melmane^[3] included 50 patients and showed graft edema in four eyes in conjunctival autograft group and none in amniotic membrane group. Another study by Kurna *et al.*^[6] included 75 patients. Twenty-eight eyes underwent limbal conjunctival sliding flap transplantation, 22 eyes underwent amniotic membrane grafting and 25 eyes underwent primary closing surgery. No significant complications were observed.

Studies by Okoye *et al.*^[7] and Arain *et al.*^[8] on pterygium surgery with adjunctive amniotic membrane graft showed no significant complications and concluded that amniotic membrane graft is a safe and effective procedure for pterygium management.

In a study of 287 eyes by Luanratanakorn *et al.*^[9] done to determine whether amniotic membrane can be used as an alternative to conjunctival autograft after pterygium excision, no major complications were observed except for two cases of conjunctival granuloma and one case of graft edema in amniotic membrane graft group. They concluded that AMG is a safe alternative to conjunctival autograft.

CONCLUSION

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

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Clinical Study of Ocular Manifestations of Thyroid Disease in Tertiary Eye Care Center

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Abstract

Introduction: Thyroid eye disease (TED), Graves' ophthalmopathy, or Thyroid associated orbitopathy (TAO) are an immune-mediated inflammatory disorder that produces expansion of the extraocular muscles and fat in the orbit. TED is most commonly associated with Graves' hyperthyroidism but can also be noted in hypothyroid and euthyroid states.

Aim: The aim of the study is to evaluate the ocular manifestation of thyroid dysfunction (TD).

Materials and Methods: A prospective non-randomized observational study was carried out on 106 patients of TD. They were examined in detail for demography, systemic, and ocular examination and laboratory investigation. Period of study was 1 year.

Results: In this study, average age of presentation of TD was 42.54 years. Female-to-male ratio was 3.1:1. Lid retraction was the most common (82.4%) lid sign in patients of hyperthyroidism while in patients of hypothyroidism, it was lid edema (28.9%). The second most common lid sign was lid lag which was present 70.6% cases. Proptosis was present in 52.9% hyperthyroid patients. Three patients had unilateral proptosis. Corneal ulcer (due to exposure keratopathy) was present in 17.6% of hyperthyroid patients.

Conclusion: Females were more commonly affected. However, ocular manifestations were more severe in male. Hence, it is important to rule out TD in patient with other ocular symptom.

Key words: Graves' ophthalmopathy, Thyroid-associated orbitopathy, Thyroid eye disease

INTRODUCTION

TED, GO, or TAO is an immune-mediated inflammatory disorder that produces expansion of the extraocular muscles and fat in the orbit. TED is most commonly associated with Graves' hyperthyroidism but can also be noted in hypothyroid and euthyroid states.^[1]

It is part of a systemic process with variable expression in the eyes, thyroid and skin caused by autoantibodies that bind to tissues in those organs and in general, occurs with hyperthyroidism. The most common form of

hyperthyroidism is Graves' disease. About 10% of cases do not have Graves' disease but do have autoantibodies. The autoantibodies target the fibroblasts in the eye muscles, and those fibroblasts can differentiate into fat cells (adipocytes). Fat cells and muscles expand and become inflamed. Veins become compressed and are unable to drain fluid causing edema. Swelling of the fatty tissue can cause the eyes to become red. This can also cause the eyes to be pushed forward (staring eyes and proptosis). In severe cases, the damage at the back of the eye can cause swelling and stiffness of the muscles that move the eye causing double vision, especially when you look from side to side as the muscles cannot keep the eyes exactly in line with each other.^[2]

The acute progression of the disease is an ocular emergency, particularly optic nerve compression and corneal disease secondary to exposure. However, TED may occur in patients who have hypothyroidism (most commonly Hashimoto's thyroiditis) or euthyroidism. The two most serious signs are optic neuropathy and exposure

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keratopathy as both can abruptly lead to blindness, so they should be treated as ocular emergencies.^[3]

It has been established that receptors of thyroid hormones are present in all tissues and organs of the body. It is quite credible that tonicity of ciliary muscles (smooth fibers) also depends on the activity of thyroid gland. That is why hyperthyroidism can cause refractive changes, mostly those of myopia.^[4]

There are several risk factors of thyroid disease. Smoking is one of them; smoking is a risk factor for the development of TAO, an inflammatory process primarily affecting the fibroblasts in extraocular muscles.^[5]

TD and diabetes mellitus are endocrine disorders most commonly seen in clinical practice. Both mutually influence each other and reported as has been reported in literature. On the one hand, thyroid hormones effects carbohydrate metabolism, and on the other hand, diabetes influences thyroid function. Many trials have shown immunological and genetic correlation between the two types of disorders.^[6,7]

Aims and Objectives

1. To study the different types of ocular manifestation of thyroid disease
2. To assess the risk factors associated with TED
3. To find the association of thyroid disease with diabetes mellitus.

MATERIALS AND METHODS

This prospective study was carried out in the Department of Ophthalmology, S. S. Medical College and Gandhi Medical Hospital, Rewa, Madhya Pradesh, India, during the period from March 2016 to September 2017.

Case Selection

A total of 220 eyes of 110 patients attending the outpatient department, having TD, and fulfilling the following criteria were enrolled in the study.

Inclusion Criteria

- a. All patients with diagnosed thyroid disease
- b. Age >15
- c. Those who are willing to sign informed consent form.

Exclusion Criteria

- a. Congenital thyroid disease
- b. Ocular manifestation of other systemic diseases
- c. Any other ophthalmic disorder
- d. Undergone any ophthalmic surgery
- e. Those not willing to sign the consent form.

Data Collection and Method

Participants who satisfy all inclusion criteria and meet no exclusion criteria were included in the study. Informed consent was taken. The purpose of study was explained to the participants, and confidentiality was assured.

After taking a verbal consent, a detailed clinical history was taken including the chief visual complaint, history of present illness, past history, personal history, medical history, family, and professional history. General examination and systemic examination were done; all positive findings were recorded. Ocular manifestations of TED were classified according to the NOSPECS classification of TAO.

Investigations

Thyroid function test of T₃, T₄, and *thyroid-stimulating hormone* was sent all patients if not done. Color vision was performed. Visual field test was done in case of open-angle glaucoma. In cases of corneal ulcer, corneal scraping and culture were done. B scan for orbit was performed in all cases of proptosis. Computed tomography scan was ordered in cases of proptosis and with any one of the signs of vision threatening condition like exposure keratopathy, squint and optic neuropathy.

Data Analysis

Statistical analyses were performed. Pearson's Chi-square test, likelihood ratio, and Fisher's test were used for the comparison of categorical variables, and Student's *t*-test was used for the comparison of continuous variables. Finally, a $P < 0.05$ was considered as statistically significant. Mean was used as a measure of central tendency. Similarly, standard deviation (SD) and range were used as a measure of dispersion. The prevalence was calculated in percentage at 95% confidence interval.

Table 1: Number of smokers and non-smokers

Thyroid status	Frequency (%)	
	Smokers	Non-smokers
Hyperthyroid (n=19)	12 (63.2)	7 (36.9)
Hypothyroid (n=80)	13 (16.3)	67 (83.8)
Euthyroid (n=11)	-	11 (100)
Total (n=110)	25 (22.7)	85 (77.3)

Table 2: Distribution of diabetes mellitus in the study population

Thyroid status	Frequency (%)	
	Diabetic	Non-diabetic
Hyperthyroid (n=19)	12 (63.2)	7 (36.9)
Hypothyroid (n=80)	16 (20.0)	64 (80)
Euthyroid (n=11)	-	11 (100)
Total (n=110)	28 (25.5)	82 (74.5)

For risk factor, univariate as well as multivariate analysis were performed, and odds ratio was calculated. The level of significance was set at 95%.

RESULTS

According to history, clinical examination, ocular examination, and laboratory investigation, patients were divided into three group hyperthyroid, hypothyroid, and euthyroid.

The maximum number of patients was found in the age group of 41–50 year which is 39.09% of the cases, and the next highest number of patients was found in the age group 31–40 (30.90%). Mean age of patients was 42.54 years (SD-9.5). Among 110 patients studied, 24.54%

were males and 75.5% were females. In this study, ratio is F:M = 3.1:1. Among 110 patients, 19 (17.3%) were hyperthyroid, 80 (72.7%) were hypothyroid, and 11 (10%) patients were euthyroid.

Among 110 patients, 25 (22.7%) were smokers. There was a significant association of smoking with thyroid disease ($P < 0.05$) [Table 1].

Among 110 patients, 28 (25.5%) were diabetic. There was a significant association of diabetes mellitus with thyroid disease ($P < 0.05$) [Table 2].

Table 3 shows the ocular manifestation in study group. Among 110 patients, 55 patients had ocular manifestation. Out of 55 patients, 17 (30.9%) patients of hyperthyroid had ocular manifestations and 38 (69%) patients of hypothyroid had ocular manifestations.

Table 4 shows the frequency of different symptoms among the study group. Most of the patients came with complaint of foreign body sensation (38.4%). The second most common symptom was itching (36.4%). Lid swelling and proptosis were common.

Table 5 shows the different types of signs among these two groups. In hyperthyroid lid, retraction was more common (82.4%). In hypothyroid lid, edema was more common (28.9%). Frequency of dry eye syndrome in patients with TD was present; 29 (26.4%) patients had dry eye disease. In hyperthyroid patients, 9 (47.4%) had dry eye syndrome, and in hypothyroid, 20 (25%) patients had dry eye syndrome. In the study group, the mean value of exophthalmometry was 16.73 with 1.79 SD. The association was statistically significant ($P < 0.05$). Among 110 patients, proptosis was present in 9 patients in which 6 patients had bilateral proptosis and 3 patients had unilateral proptosis. Most of the patients were myopic. There was a significant association ($P = 0.006$) of refractive error in thyroid. Among 110 patients, 42 (38.2%) were myopic and 13 (11.8) were hypermetropic.

Table 3: Ocular manifestations (n=55)

Thyroid status	Frequency (%)		
	Male	Female	Total
Hyperthyroid	7 (12.7)	10 (18.2)	17 (30.9)
Hypothyroid	8 (14.5)	30 (54.5)	38 (69.0)
Total	15 (27.3)	40 (72.7)	55 (100)

Table 4: Symptoms of thyroid eye disease patients (n=110)

Symptoms	Frequency (%)
FB sensation	42 (38.2)
Itching	40 (36.4)
Dry eye	29 (26.4)
Lid swelling	16 (14.5)
Difficulty in reading	16 (14.5)
Redness	14 (12.7)
Protrusion of eye	9 (8.2)
Diminution of vision	6 (5.5)
Watering	3 (2.7)
Double vision	1 (0.9)
Others	6 (5.5)

FB: Foreign body

Table 5: Signs in thyroid eye disease

Signs	Hyperthyroid (n=17), n (%)	Hypothyroid (n=38), n (%)	P
Lid edema (Enroth's sign)	8 (47.1)	11 (28.9)	0.000
Lid retraction (Dalrymple sign)	14 (82.4)	-	0.000
Lid lag (Graefe's sign)	12 (70.6)	-	0.000
Conjunctival congestion	11 (64.7)	3 (7.8)	0.000
Corneal ulcer	3 (17.6)	1 (2.6)	0.000
Proptosis	9 (52.9)	-	0.000
Scleral show	9 (52.9)	-	0.000
Increased palpebral aperture	16 (94.1)	-	0.000
Restrictive myopathy	1 (5.9)	-	0.000
Refractive error	17 (100)	38 (100)	0.006
Increase IOP with optic disk and visual field change	1 (5.9)	-	0.000

IOP: Intraocular pressure

DISCUSSION

Thyroid disease is an autoimmune disorder, affects females more commonly, and is seen in the 4th and 5th decades of life and commonly in females as cited by many previous studies. The mean age of presentation of the TED was 42.54 years in our study. This was similar to the results of Bartley *et al.*^[8] who reported median age as of 43 years and 39.7 years by Palikhe Sabita *et al.*^[9] who documented 39.7 years as the median age.

There was female preponderance in our study. Out of 110 patients, 83 (45.46%) were female and 27 (24.54%) were male. This was similar to the results of Palikhe *et al.*^[9] who reported 80 (68.4%) patients were females and 37 (31.6%) were male. We found that there is a significant association of TD and diabetes mellitus. In hyperthyroid patients, 63.2% had diabetes mellitus, and in hypothyroid, 19.3% had diabetes mellitus which was similar to results shown by Demitrost and Ranabir^[10] and Maskey *et al.*^[11]

In our study, we observed a significant association of smoking with TD. History of smoking was positive in 22.7% similar to results shown by Tellez *et al.*^[12]

The prevalence of TED in TD in our study was 50%. Variable prevalence rates have been reported in literature. It was reported as low as 17.3% by Woo *et al.*^[13] and as high as 51.7% by Manji *et al.*^[14] and 71.7% by Palikhe *et al.*^[9] The difference in the prevalence of TED between our study and others may be attributed to the definition of TED in our study. We have defined TED as the presence of any one sign of TED (NOSPECS), while other studies have taken at least two signs. In a study done in India by Kashkouli *et al.*,^[15] the prevalence was 35.6%.

TED can occur in any form of TD either hyper, hypo, or euthyroid state. In our study, out of 55 TED patients, 17 (30.8%) were hyperthyroid and 38 (69.2%) were hypothyroid. The study by Palikhe *et al.*^[9] showed that out of 84 TED patients, 63 (75%) were hyperthyroid, 14 (16.7%) were hypothyroid, and 7 (8.3%) were euthyroid. A study reported by Bartley *et al.*^[8] at Mayo Clinic, Rochester, USA, has cited that 90% patients were hyperthyroid, 6% euthyroid, 1% had primary hyperthyroidism, and 3% had Hashimoto's thyroiditis [Figure 1].

Our study showed that eyelid retraction [Figure 2] was present in 82.4% ($n = 17$) which was similar to results of Palikhe *et al.*^[9] by 79.8% and Bartley *et al.*^[8] by 90%. Another study by Saks *et al.*^[16] reported that lid retraction was present in 98% of the patients. Similarly, lid lag [Figure 3] was present in 70.6% ($n = 17$) of cases in our study while it was

reported as 76.2% by Palikhe *et al.*^[9] and 43.33% by Bartley *et al.*^[8] This difference could be due to ethnic variation and also due to varying degree of disease severity.

Exophthalmos is the most widely known sign of TED and occurs in 20%–30% of patients with Graves' disease and up to 40%–70% of patients with thyroid-associated ophthalmopathy. It is bilateral in 80%–90% of cases. In our study, exophthalmos was present in 52.9% ($n = 17$) cases of hyperthyroid which was similar to that in study by Palikhe *et al.*,^[9] they found 33.3% cases out of which 68% and Jarusaitiene *et al.*^[17] found 65.8% cases of proptosis [Figure 4 and 5].

Restrictive extraocular myopathy was seen in only in 5.9% in patients with hyperthyroidism. This finding is similar to that found in the study by Palikhe *et al.*^[9]

In our study, corneal ulcer was seen in 17.6 % of cases of hyperthyroidism. Bartley *et al.*^[8] reported 10% of cases with corneal involvement and Palikhe *et al.*^[9] reported 7.1% cases of corneal ulcer.

We found diplopia was noted in 0.9 % cases. Bartley *et al.*^[8] reported 17% of the patients presenting with diplopia. Palikhe *et al.*^[9] reported 4.8% cases.

In our series of the patients, most common complaints of patients were foreign body sensation, itching, and painless swelling of the lid [Figure 6]; this was consistent with that noted by Palikhe *et al.*^[9] Diminution of vision was present in 5.5% of cases which was in accordance with the study of Bartley *et al.*^[8] who reported decreased vision in 5%–9% of cases while Palikhe *et al.*^[9] reported 1.2% of cases of reduced visual acuity.

TED has been found to be usually associated with glaucoma. The possible cause of increased intraocular pressure (IOP) and thus causing optic neuropathy might be increased episcleral pressure which hinders the outflow thus increasing IOP. The other mechanism of increased IOP might be compression of the globe by inflamed and fibrosed inferior rectus muscle.



Figure 1: Thyroid gland enlargement



Figure 2: Dalrymple's sign (lid retraction)



Figure 3: Von Graefe's sign

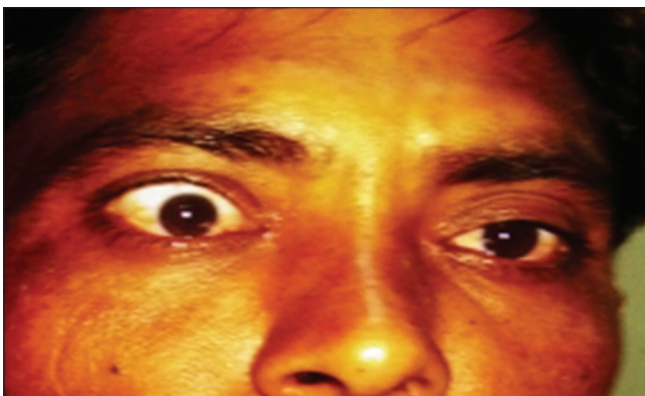


Figure 4: Unilateral proptosis

In our study of the total number of patients with TED, 55 patients, in which accounted for 17 (30.9%) cases, had hyperthyroid. Out of 17, only 1 case (5.9%) had primary open-angle glaucoma and 3 cases were glaucoma suspects. Palikhe *et al.*^[9] found 8.3% cases of primary open-angle glaucoma, Cross *et al.*^[18] found 6.5% cases of primary open angle glaucoma, and Sultana *et al.*^[19] reported 7.5% cases of primary open-angle glaucoma. Cockerham *et al.*^[20] reviewed 500 patients with TED and found 120 (24%) had increased IOP. Of this, 2% developed glaucomatous field defect over a follow-up of 48 months.

In our study, most of the patient with TED had myopic shift, with 63.2% cases having hyperthyroidism



Figure 5: Kocher's sign (staring look)



Figure 6: Enroth's sign (fullness of eyelids)



Figure 7: Lagophthalmos

and 37.5 % cases having hypothyroid. Only 21.2% of hyperthyroid patients and 11.2% of hypothyroid patients had hypermetropia. Jankauskiene *et al.*^[21] found that the excess of thyroid hormones brought about by the mutation of receptors of thyroid hormones had an influence on the development of myopia. Chandrasekaran *et al.*^[22] noted that myopic shift after decompression is consistent with mechanisms involving the posterior pole. Combination of enlarged extraocular muscles, anterior displacement of the globe, and orbital hypertension related to elevated muscle and fat volumes in endocrine ophthalmopathy flattens the posterior pole, which may produce choroidal folds.

Other ocular pathology like dry eyes was seen in 47.4% ($n = 19$) hyperthyroid and 20% ($n = 80$) hypothyroid



Figure 8: Computed tomography scan showing medial rectus muscle hypertrophy

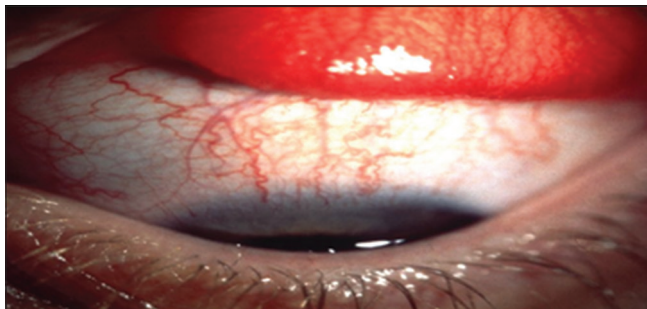


Figure 9: Superior limbic keratoconjunctivitis

patients in our study. This may be due to exposure or due to the immunological process associated with TED. It is cited in literature that five factors potentially associated with corneal exposure-palpebral fissure width, exophthalmos, lagophthalmos [Figure 7], and lid lag. All the factors were evaluated in 19 patients with Graves' disease in a study to determine which were associated with ocular surface damage. Multiple regression analysis revealed that increased palpebral fissure width and proptosis were both significant predictors of ocular surface damage. However, Schirmer test score and tear film breakup time value were not significant predictors. This finding was similar to that in study by Gürdal *et al.*^[23] but dissimilar to that in study by Eckstein *et al.*^[24] who found that Schirmer test and tear film breakup time were significant predictors [Figure 8 and 9].

CONCLUSION

- TED affects the majority of thyroid disease patients. The ocular manifestations were present 52.28% patients
- Females are affected most commonly but severity of disease more in males. The common lid manifestation was lid lag and lid retraction
- Ocular manifestations are more in hyperthyroidism than hypothyroidism.

Limitations of Study

- Since our sample size was small due to lesser number of patients attending outpatient department, this was insufficient to estimate the exact prevalence of ocular manifestations of thyroid disease
- Some patients with TD were taking systemic steroid and other immunosuppressive drug due to some other systemic disease, these drugs are known to be having anti-inflammatory effects, and this can be a confounding factor in our study
- The presence of severe degree of eye involvement in our set up may be due to late presentation and due to unawareness of their disease process at presentation. It may be due to our center being tertiary eye center, and we get majority of complicated and referred cases.

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Submandibular Gland Fossa Assessment with Cone Beam Computed Tomography

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Abstract

Introduction: Cone beam computed tomography (CBCT) is often used in pre-implant planning where it helps assessing the amount of bone availability and its relationship from its surrounding structures. In certain vital areas such as inferior alveolar nerve canal and submandibular gland fossa, it is important to know the dimensions of the bone to avoid post-operative complications. The aim of the study was to evaluate the deepest area or the concavity depth submandibular fossa on CBCT and also to measure/determine the distance from the mental foramen to the deepest concavity depth and the height of alveolar crest from the deepest concavity depth.

Materials and Methods: Retrospective studies of CBCT images were obtained on a KODAK 9000 three-dimensional (3D) extraoral imaging systems using CS 3D imaging software. The site of the submandibular gland fossa was identified, and measurements were done to evaluate the depth of the fossa, its distance from the alveolar crest and from the mental foramen.

Results: The lingual concavity depth over a range up to a maximum value of 3.70 mm and the minimum depth up to 0.5 mm. Analysis of variance compared the mean values and standard deviation for mandibular measurements between male and female. The sexes did not differ significantly. Independent sample *t*-test did not demonstrate any difference among the age group, $P > 0.05$.

Conclusion: CBCT is an important tool for assessing the mandibular region and planning for safe implant placement in the posterior mandible.

Key words: Cone beam computed tomography, Implant planning, Submandibular gland fossa

INTRODUCTION

Cone beam computed tomography (CBCT) is the most advanced imaging modality with wide applications in implant dentistry^[1].

the submandibular gland (SMG), the second largest gland, is about one half the weight of the parotid and is found inferior to the mandible, between the anterior and posterior bellies of the digastric muscle. In the mandibular posterior region, prior to implant placement it is mandatory to know

the depth of submandibular gland fossa i.e., deeper fossa,^[2] if undiagnosed prior to the implant placement could lead to the perforation of lingual plate, so pre surgical imaging provides valuable information in the assessment of potential implant fixture sites. One of the major cause for failure of dental implant in mandibular posterior region is the perforation into the submandibular fossa. Which can be serious complication in mandibular symphysis^[2]. The submandibular gland is lodged in this fossa shows submental and sublingual arteries may course intimately to the lingual cortical plate from the floor of the mouth.^[2] Hence the aim of our study is for the assessment of submandibular gland fossa with cone beam computed tomography.

MATERIALS AND METHODS

The study was conducted at the Department of Oral Medicine and Radiology, DY Patil University School of

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Dentistry, Navi Mumbai, Maharashtra, India, between June 2016 and October 2016. A 100 scans were browsed (single volume, unilateral side, and dentulous dentition) and fulfilled the inclusion criteria. Out of them, 56 (56.00%) were male and 44 (44.00%) were female [Table 1].

Images of 100 dentulous mandibular posterior regions were studied. The CBCT images were obtained with a KODAK 9000 three-dimensional (3D) extraoral imaging systems (manufacturer/distributor-Kodak dental systems, Carestream Health, Rochester, NY) and HP Windows

Table 1: Distribution of participants according to gender

Gender	Frequency
Male	56 (56.0)
Female	44 (44.0)
Total	100 (100.0)



Figure 1: Showing how the image is traced to the deepest concavity (Sagittal view) through cone beam computed tomography



Figure 2: Image shows how to locate the deepest concavity

desktop (Compaq le1911). The resultant image is showed in Figure 1. The software used was CS 3D imaging software 3.3.11. Operating parameters were set at 8.0 mA and 88 KV and exposure time of 10.8 s for single volume and 10 mA, 70 KV, 32.40 s for stitched volume. Voxel size was 76 μ m for single volume and was measured on 76 μ m slice thickness.

For single volumes, focused field of view was used around 500 mm \times 38 mm. The 3D volume stitching program combines up to 3 focused field volumes, automatically constructing an extended field image of around 85 mm \times 66 mm \times 37 mm.

- The tangent line is drawn from prominent superior and inferior point's lingual concavity corresponding with the submandibular fossa on para planar slices resultant value was (7.3 mm) shown in Figures 2-4.

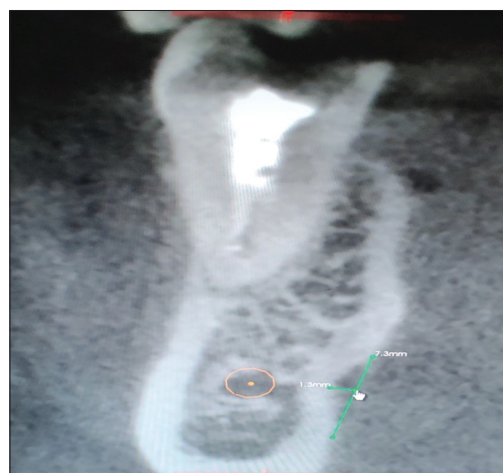


Figure 3: A second line is then drawn from the deepest point of the fossa perpendicular to the first line (Measured with the caliper of the software in mm). The slice in which the fossa was deepest was chosen as a representing maximum depth of submandibular fossa



Figure 4: Third measurement was done by joining the crest of the alveolar bone to the point of the greatest depth

- Distance from mental foramen to submandibular gland fossa was (24.3 mm) shown in [Figure 5].

RESULTS

The following statistical methods were employed in the present study.

- Descriptive statistics, mean and standard deviation.
- Independent sample *t*-test

Statistical Analysis

Descriptive and analytical statistics were done. Independent sample *t*-test was used to compare difference in gender and

age with measured anatomical landmarks of submandibular gland fossa showing frequency distribution using CBCT images [Figure 6]. SPSS (statistical package for social sciences) version 20.1 (Chicago, USA Inc.,) software was used.

Analysis of variance compared the mean values and standard deviation for mandibular measurements in male and female [Table 2]. The gender did not differ significantly in all measurements [Table 2] ($P > 0.05$).

100 samples were taken to calculate greatest depth of submandibular fossa. Among them, 56 (56.00%) were males and 44 (44.00%) were females. The average depth was 2.0 ± 2.11 (mean value \pm SD). The minimum depth was 0.5 mm and maximum depth was 3.70 mm. Independent sample *t*-test did not demonstrate any deference among the age group. $P > 0.05$ is statistically not significant.

DISCUSSION

This retrospective study carried out on dentate patient with a total of 100 CBCT scans (single volume) of the mandibular posterior region were selected for the study. The records or the scan volumes of 56 males and 44 females were included in the study [Table 1].

The depth of submandibular gland fossa was found to have the maximum depth of 3.70 mm, minimum 0.5 mm, irrespective of age and gender.

In the posterior mandibular region before implant placement, it is mandatory to know the depth of submandibular gland fossa,^[3] i.e. deeper fossa,^[4] if undiagnosed before the implant placement of the implant could lead to the perforation of lingual plate,^[5] thus causing bleeding from iatrogenic injuries in the floor of the mouth.^[5] A perforation at the molar area can be serious complication then to be in mandibular symphysis region as this region contains branches of sublingual, submental, and mylohyoid arteries.^[6] It should be thus emphasized that prior to implant placement the height and depth of mandibular bone in the region of submandibular gland fossa should decide the diameter of the implant to eliminate risk of perforation.^[7]



Figure 5: Distances from mental foramen to submandibular fossa

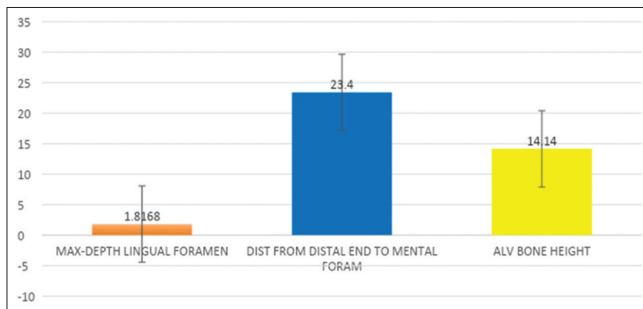


Figure 6: The frequency distribution of anatomical landmarks of submandibular fossa on cone beam computed tomography images

Table 2: Association of age with variables using independent sample test

Parameters	Age (in years)	n	Mean	Standard deviation	Standard error mean	t-test [#]
Max-depth lingual concavity	>35	26	1.8769	0.47859	0.09386	0.705
	<35	74	2.0608	0.44635	0.28438	
Distance from distal end to mental foramen	>35	26	24.4577	5.56656	1.09169	0.353
	<35	74	23.0622	6.86908	0.79851	
Alveolar bone height (from crest to lingual concavity)	>35	26	14.5192	2.34385	0.45967	0.345
	<35	74	14.0135	2.33363	0.27128	

The depth of the fossa males was 1.86 mm and females was 1.74 mm showing no gender influence on depth of SGF, whereas according to Acar^[8] and Kamburo, glu^[9] in 2014 found that the average depth and volume values for submandibular fossa were 31.5 mm and 30.7 mm and 1.3 mm and 26.5 mm³ for sublingual fossa, respectively among the two age criteria >35 years and < 35-year depth to be more in elderly patient which could be attributed to bone remodeling. Whereas in our study, maximum depth of submandibular gland fossa was found 3.70 mm, minimum was 0.5 mm, irrespective of age and gender.

de Souza^[10] in 2016 studied of which forty-one scans (41%) were from male patients and 59 (59%) were from female patients. Patient age ranged between 18 and 84 years with an average age of 51.37 years. The submandibular gland fossa depth and implant-bone thickness had a significant effect on the variability of the sample (46.1% and 22.3%, respectively). In our study, both the gender did not show significantly in all measurements [description is given in Table 5] ($P > 0.05$).

100 samples were taken to calculate greatest depth of submandibular fossa. Among them, 56 (56.00%) were males and 44 (44.00%) were females. The average depth was 2.0 ± 2.11 (mean value \pm SD). The minimum depth was 0.5 mm and maximum depth was 3.70 mm.

Marc Q in 2003^[6] found the deepest point of submandibular gland fossa (with a depth of 6 ± 2.6 mm) with a distance of the deepest fossa to the alveolus height in that area ranging from 4.2 mm to 11.9 mm.^[6] The morphologic parameters were influenced neither by age nor by gender.^[6] Whereas in our study, minimum depth was 0.5 mm and maximum depth was 3.70 mm with age <35 years having dentulous dentition. Furthermore, in our study, the distance of the deepest portion of the fossa to the alveolus found 14.8 mm in patient >35 years and <35 years, 14.01 mm.

With the advance in technology such as cone beam computerised tomography, with third dimension of submandibular gland fossa and its relation to its alveolar ridge can be appreciated more accurate lately.^[11] This should lead to predictable dental implant replacement with less risk of perforation in submandibular gland fossa.^[12]

CONCLUSION

For year's researcher have been trying to evaluate submandibular gland fossa by using conventional radiography such as IOPA and OPG's (orthopantomographs).^[13]

Clinician palpation is usually not a reliable to evaluate

submandibular gland fossa; on the other hand,^[14] correctional image obtained from CT and CBCT is seen to how favorable outcome.

In the present study, the maximum depth of submandibular gland fossa was (3.7 mm) and minimum (0.5 mm) with mean of (1.68 mm). The average/mean distance from distal end of the mental foramen to deepest point of submandibular gland fossa was (23.4250) mm.

The mean value of measuring the height from the deepest point of submandibular fossa till the alveolar crest is (14.1450) mm. We thus found that gender and age had no influence on the dimension of the fossa.^[15,16]

It can be concluded that submandibular fossa is well perceived only by cross-sectional imaging.^[17] Images acquired using two-dimensional (height and width)^[18,19] radiography cannot reveal valuable information in the third dimension (depth).^[20] This fact limits its use. In certain situations, for example, deep SF for implant selection, 3D visualization of the anatomical limitation is desirable.^[21-23] In those circumstances, 3D imaging provided by CBCT is extremely valuable.^[20] In comparison to panoramic radiograph, the use of CBCT can greatly improve the visualization leading to a more definitive diagnosis and the best possible treatment plan.^[8,24,25]

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Magnetic Resonance Imaging in Evaluation of Hip Pain

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Abstract

Introduction: Hip pain is a common problem and a major disabling condition that affects patients of all ages. Magnetic resonance imaging (MRI) plays an important role as it provides valuable information regarding various hip pathologies. Thus, it is the modality of choice for evaluation of hip pain as it has a profound impact on the subsequent treatment and is useful tool for the clinicians.

Aims and Objectives: This study aims to assess the role of MRI in evaluation of painful hip joints and to describe the imaging features along with differential diagnosis of the various hip pathologies.

Materials and Methods: In this prospective study, 50 patients of all age groups with hip pain were evaluated by MRI hip in the Department of Radiodiagnosis, Gandhi Medical College and Hamidia Hospital, over a period of 1 year. MRI hip was performed on 1.5 Tesla Hitachi ECHELON SMART - 523 MRI machine using the required protocol and sequences. The possible diagnosis was given and non-specific imaging findings were further confirmed by cytology/histopathology wherever indicated.

Results: In our study of 50 cases, MRI could detect the exact cause of hip pain in 49 patients. The most common cause was avascular necrosis of femoral head (50%) followed by infective arthritis (12%). Other causes were transient synovitis, sacroiliitis, osteoarthritis, slipped capital femoral epiphysis, Perthes disease, and various neoplastic conditions of the hip.

Conclusion: This study concludes that MRI proved as a valuable imaging modality to accurately diagnose various pathologies affecting hip.

Key words: Avascular necrosis, Magnetic resonance imaging, Painful hip

INTRODUCTION

Hip pain is very common in all age groups with wide spectrum of differential diagnosis. Magnetic resonance imaging (MRI) plays an important role in the delineation of hip pathologies, as it provides excellent soft tissue resolution, multiplanar imaging and is non-invasive without the risk of ionizing radiation.

MRI provides valuable information regarding occult bony pathologies such as bone marrow edema, subtle femoral

head changes, early avascular necrosis (AVN), bony infarcts, and early degenerative changes. Its superior soft tissue contrast also helps in detecting anatomical details, articular cartilage injury, synovial pathologies joint effusion, surrounding periarticular soft tissue abscess, and tumors.

Thus, MRI is the modality of choice for evaluation of hip pain as it has a profound impact on the subsequent treatment and is useful tool for the clinicians. Hence, the aim of our study was to study the spectrum of imaging findings depicted on MRI in patients with hip pain.

MATERIALS AND METHODS

The study is a prospective study on 50 patients with hip pain referred to the Department of Radiodiagnosis, Gandhi Medical College and Hamidia Hospital, Bhopal. The study was undertaken over a period of 1 year after taking written informed consents from all patients.

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Inclusion Criteria

The following criteria were included in the study:

- Patients presenting with unilateral or bilateral hip pain
- Patients of all age groups and both sexes.

Table 1: Age distribution

Age groups (in years)	Number of cases	Percentage
1–10	5	10
10–20	9	18
21–30	15	30
31–40	14	28
41–50	2	4
51–60	3	6
61–70	2	4

Table 2: Spectrum of magnetic resonance imaging findings in patients with hip pain

Diagnosis	Number of patients	Percentage
Avascular necrosis	25	50
Infective arthritis	6	12
Transient synovitis	3	6
Osteoarthritis	3	6
Sacroiliitis	3	6
Perthes disease	1	2
SCFE	1	2
Chondrosarcoma	1	2
Chondroblastoma	1	2
Metastasis	2	4
Multiple myeloma	1	2
Aneurysmal cyst	1	2
Soft tissue sarcoma	1	2
No abnormality detected	1	2

SCFE: Slipped capital femoral epiphysis

Table 3: Risk factors for AVN

Risk factors	Number of patients (n=25)	Percentage
Idiopathic	5	20
Steroids	1	4
Alcohol	10	40
Trauma	4	16
Sickle cell disease	5	20

Total number of patients diagnosed as AVN=25, AVN: Avascular necrosis

Exclusion Criteria

The following criteria were excluded from the study:

- Patients with contraindication for MRI such as metallic implants, cardiac pacemakers, aneurysmal clips, and cochlear implants
- Patients with claustrophobia
- Patients with recent trauma.

MRI hip was performed on 1.5 Tesla MRI Hitachi ECHELON SMART 523 machines with the help of dedicated surface coil. Patients were asked to lie in a supine position and both hips were scanned simultaneously using hip protocol. The sequences obtained were T1 weighted, T2 weighted, short-tau inversion recovery (STIR), proton-density fat saturation (PDFS) coronal images, and T1-weighted and T2-weighted axial images with PDFS sagittal images. Intravenous contrast (Gadolinium at 0.1 mmol/kg) was administered when thought necessary (infective, inflammatory, and neoplastic cases) and scans were taken in axial, sagittal, and coronal planes. Final diagnosis was based on clinical, laboratory, and imaging findings and further confirmed by histopathology wherever indicated.

RESULTS

In our studies of 50 patients with hip pain, we observed the following results:

- The age range of patients was from 5 to 72 years (mean = 29.6 years).
- The maximum number of cases, i.e., 15 was in the age group of 21–30 years [Table 1].
- There was a male predominance with 35 cases (70%) and females were 15 (%).
- Unilateral hip pathologies were seen in 30 cases, the common causes were post-traumatic AVN, infective arthritis (tubercular and pyogenic arthritis), transient synovitis, Perthes disease, slipped capital femoral epiphysis (SCFE), and tumors.
- Bilateral hip pathologies were seen in 20 cases, the common causes were non-traumatic cases of AVN,

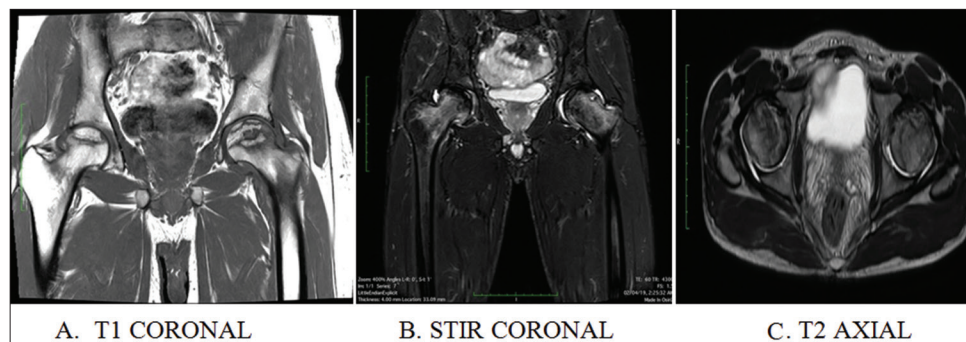


Figure 1: (A-C) Case of bilateral avascular necrosis of femoral heads showing geographical area of signal alteration in subarticular surface of bilateral femoral heads (Grade II, Ficat and Arlet classification) with adjacent short-tau inversion recovery hyperintense marrow edema



Figure 2: Case of sickle cell disease showing subarticular collapse of bilateral femoral heads with marginal osteophytes (bilateral avascular necrosis, Grade IV Ficat and Arlet classification) associated with multiple bone infarcts in greater trochanters of bilateral femurs

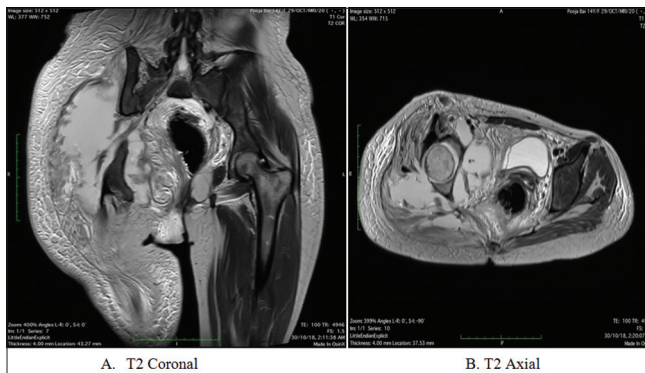


Figure 3: (A and B) Case of the right-side pyogenic arthritis with adjacent intramuscular abscess formation

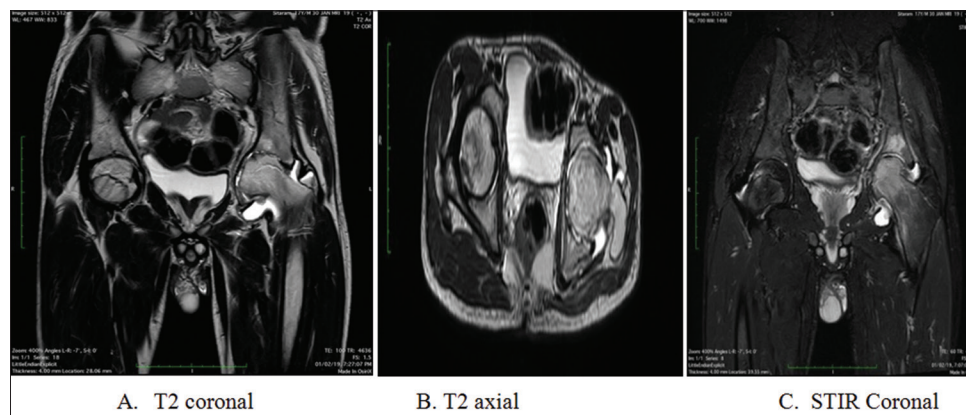


Figure 4: Case of tubercular arthritis with cortical erosions in articular surface of the left femoral head (A-C) with adjacent short-tau inversion recovery hyperintense marrow edema (C) and joint effusion in the left hip

osteoarthritis, sacroiliitis, metastasis, and multiple myeloma.

- Most common cause of hip pain was AVN of femoral head, i.e., 25 cases (50%) [Table 2].
- Infective arthritis was the second most common hip pathology seen in 6 patients (12%), four patients had a history of fever. All six cases had joint effusion, thickened enhancing synovium, signal alteration in bone marrow and soft tissues, and multiloculated periarticular abscess formation. Joint effusion aspiration finally diagnosed four cases as tubercular and two cases as pyogenic arthritis.
- Seven cases (14%) were diagnosed as tumors based on MRI findings which were then histopathologically confirmed.
- Common hip pathologies seen in children were transient synovitis, SCFE, Legg-Calve-Perthes disease, aneurysmal bone cyst, and rhabdomyosarcoma.
- Common hip pathologies seen in adults were osteoarthritis, sacroiliitis, metastasis, multiple myeloma, and chondrosarcoma. Cases of AVN were usually seen in middle age group.
- Infective arthritis was observed in all age groups.

DISCUSSION

In our prospective study of 50 patients with hip pain, the common causes with their MRI findings are as follows:

AVN

In this study, AVN was seen in half of our cases as the most common hip pathology, with prevalence in age group

Table 4: Unilateral versus bilateral AVN

Number of patients diagnosed as having AVN of the femoral head	Number of femoral heads affected by AVN	Unilateral AVN	Percentage of unilateral AVN	Bilateral AVN	Percentage of bilateral AVN
25	37	13	52%	12	48%

AVN: Avascular necrosis

from 16 to 60 years (mean 30.3 years) and a male:female ratio of 2.1:1, i.e., 17 (68%) patients were male and 8 (32%) patients were female. In the study conducted by Ito *et al.*,^[1] sex ratio was 4–8:1.

The most common age group affected in AVN was 21–30 years. The most common risk factor for AVN was alcohol seen in 10 cases (40%), followed by idiopathic cause 5 patients (20%), sickle cell disease associated with multiple

bony infarcts 5 cases (20%), trauma (4 patients, 16%), and one patient had a history of steroids intake [Table 3]. Jacob^[2] also found alcohol as the most common cause of AVN in their studies.

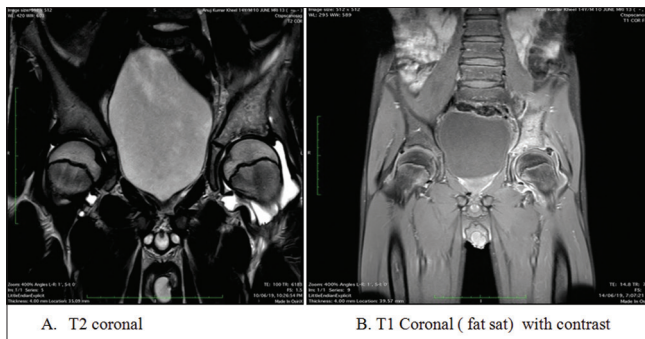


Figure 5: Case of the right-sided transient synovitis-coronal images (A and B) shows the left hip joint effusion with smooth enhancement of synovium. No evidence of marrow signal alteration or soft tissue changes seen

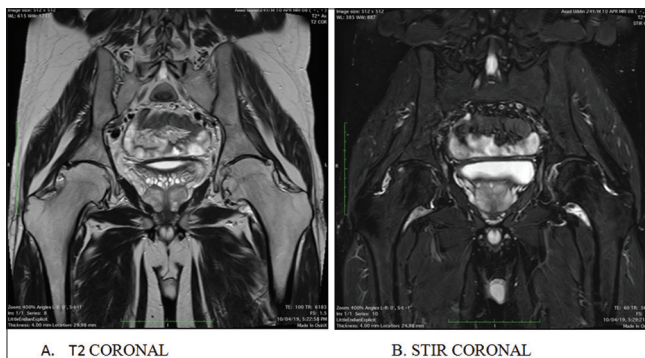


Figure 6: (A and B) Case of osteoarthritis coronal images showing marginal osteophytes with reduced joint space in bilateral hip joints

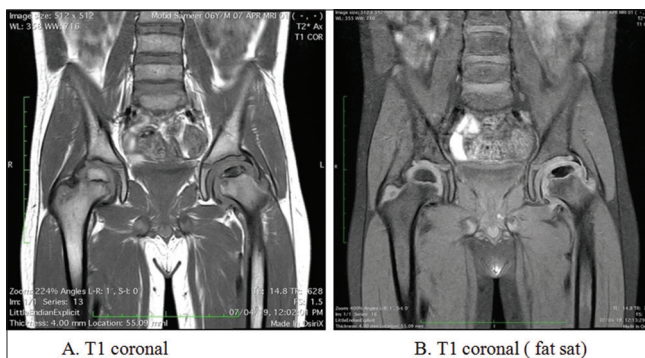


Figure 7: (A and B) Case of the left-sided Perthes disease T1W coronal image reveals hypointensity in subarticular surface of the left femoral head with focal flattening of articular surface in anterior-superior region

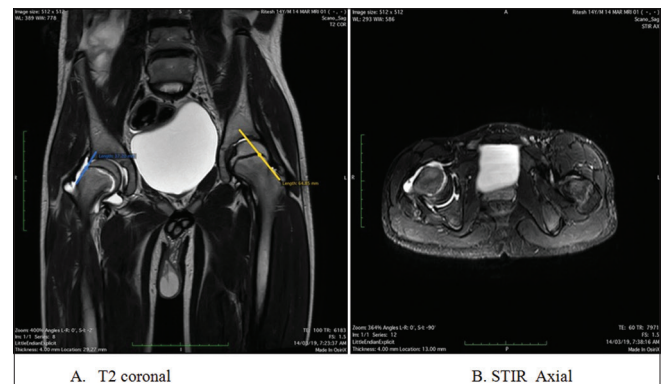


Figure 8: Case of the right-sided SCFE in a 14-year-old child (A) T2-weighted images show physeal widening, bone marrow edema, joint effusion, and positive Trethowan sign. (B) Short-tau inversion recovery axial image shows retroversion at epiphyseal metaphyseal junction of the right femur

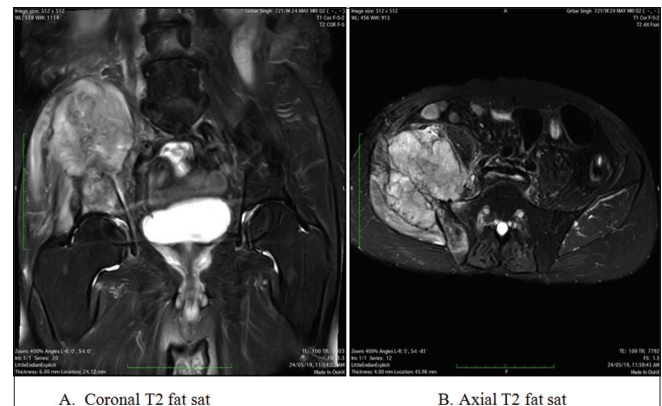


Figure 9: (A and B) T2 fat sat images show altered marrow signal in the right iliac bone with adjacent large heterogeneously enhancing mass infiltrating surrounding gluteal muscles. Histopathology revealed malignant tumor, i.e., chondrosarcoma

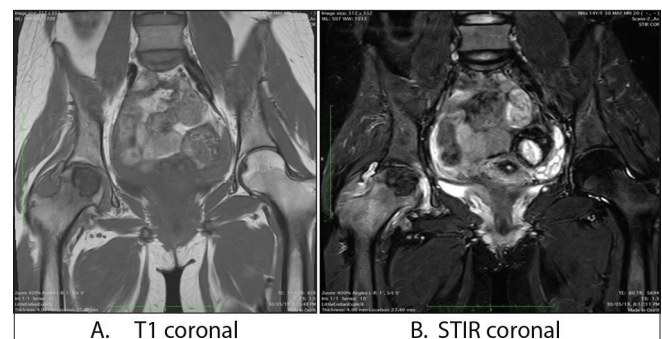


Figure 10: (A) Coronal T1 image shows well-defined lobulated T1 hypointense lesion in the epiphyseal region of the right femoral head. (B) Short-tau inversion recovery coronal images show adjacent hyperintense marrow edema. Histopathology was positive for chondroblastoma

Thirteen patients (52%) had unilateral while 12 patients (48%) had bilateral AVN [Table 4]. Thus, a total number of 37 femoral heads were involved. Unilateral AVN was associated with history of trauma and non-traumatic AVN was bilateral [Figure 1].

In our study, the most common MRI findings of AVN were focal subchondral signal abnormality (geographic pattern with sclerosis) and were seen in 24 patients (96%), followed by bone marrow edema (23 patients, 92%), associated with joint effusion (19 cases, 76%), subchondral cysts (9 cases, 36%), double line sign (12 patients, 48%) which is seen on T2-weighted sequence and consists of inner bright line representing granulation tissue and surrounding dark zone representing adjacent sclerotic bone, subarticular collapse of femoral head (5 patients, 20%), and osteophytes formation (4 patients, 16%) [Table 5]. Similar results were found by Kamal *et al.*^[3] Few cases of AVN with a history of sickle cell disease were associated with multiple infarcts [Figure 2].

Table 5: MRI findings in AVN

MRI findings	Number of patients (25)	Percentage
Focal subchondral signal abnormality (geographic pattern)	24	96
Bone marrow edema	23	92
Subchondral cyst	9	36
Subarticular collapse of femoral head	5	20
Osteophytes	4	16
Joint effusion	19	76
Double line sign	12	48

Double line sign seen on T2-weighted sequence and consists of inner bright line representing granulation tissue and surrounding dark zone representing adjacent sclerotic bone. AVN: Avascular necrosis, MRI: Magnetic resonance imaging



Figure 11: Case of metastasis from primary breast malignancy, coronal short-tau inversion recovery (STIR) image shows expansile lesion with altered marrow signals involving left ilium bone, associated with multiple areas of cortical breach and adjoining soft tissue component. Multifocal STIR hyperintense lesions were also seen in pelvic bone, bilateral proximal femur, and lower lumbar vertebrae

MRI was found to be highly sensitive and specific in evaluation of AVN and is superior over plain radiographs, which fail to pick up early disease and also helps in diagnosing AVN on contralateral hip. Glickstein *et al.*^[4] in their studies have described the role of magnetic resonance (MR) in evaluation of AVN and compared to the plain radiographs with similar results.

In our study, Grade III was the most common class (Ficat and Arlet classification) seen in 17 femoral heads (46%) out of AVN affected 37 femoral heads followed by Grade II in 10 femoral heads (27%) [Table 6]. In a study done by Kamal *et al.*,^[3] 51% of patients were diagnosed as Grade IV and 34.7% were diagnosed as Grade III.

Infective Arthritis

In our study, there were six cases of infective arthritis. Four cases proved out to be tubercular and two cases were of pyogenic arthritis. The MR features suggestive of tubercular arthritis were joint effusion, subarticular marrow edema, synovial thickening, and soft tissue involvement in the form of periarticular abscess formation. MR features in cases of pyogenic arthritis revealed marrow edema, subchondral bone involvement, joint effusion, and periarticular abscess formation [Figure 3]. After contrast administration, tubercular abscesses had thin and smooth rim enhancement while pyogenic abscesses had thick and irregular rim. Bone erosion was more common in patients with tubercular arthritis seen in three cases than in one

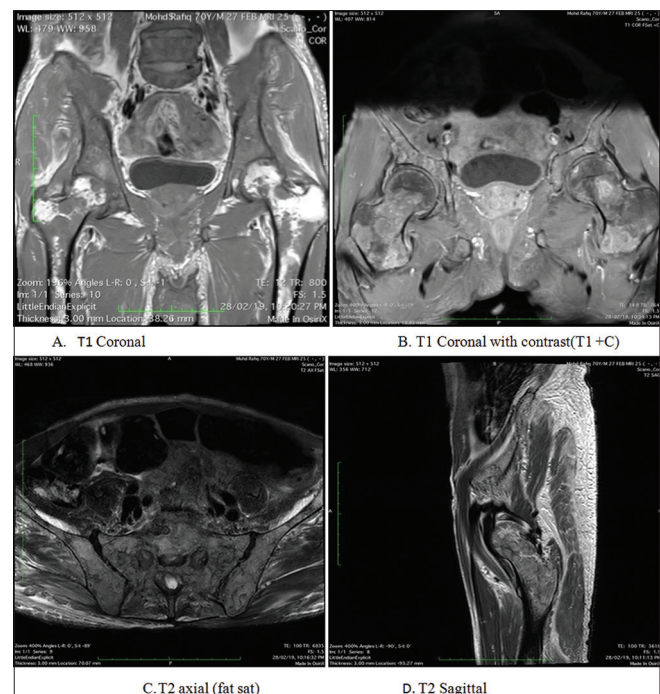


Figure 12: Coronal, axial, and sagittal images in a patient of multiple myeloma revealed multiple variable sized T1 hypointense and T2 intermediate signal intensity lesions (A, C, and D), showing post-contrast enhancement (B) noted in bilateral proximal femur, pelvic bone, and sacrum

case of pyogenic [Figure 4 and Table 7]. Hong *et al.*^[5] in their studies also described similar MR imaging features to differentiate tubercular from pyogenic arthritis.

Transient Synovitis

Three children (all <10 years) with hip pain were diagnosed as transient synovitis. MR features revealed joint effusion associated with synovial enhancement [Figure 5]. Two cases had unilateral effusion while one case had contralateral effusion. However, there was no evidence of signal alteration in the adjacent marrow [Table 8]. Similar imaging features were seen in the studies done by Yang *et al.*^[6]

Osteoarthritis

The most common age group affected was 40–70 years. MRI had role of detecting early changes of osteoarthritis compared with radiographs. The signs on MRI included reduced joint space, joint effusion, marrow edema, articular cartilage defects, subchondral cysts, and osteophytes [Figure 6]. In our study, 3 cases (6%) of osteoarthritis were found with MRI features as tabulated in Table 8. Horii *et al.*^[7] have also studied similar spectrum of MRI findings in osteoarthritis.

Table 6: Distribution of AVN cases according to Ficat and Arlet classification

Grade	Number of femoral heads affected (n=37)	Percentage
Grade I	2	5.4
Grade II	10	27
Grade III	17	46
Grade IV	8	21.6

AVN: Avascular necrosis

Table 7: Magnetic resonance imaging findings in infective arthritis (total number of cases=6)

MRI findings	Number of patients
Joint effusion	6
Thick and enhancing synovium	6
Signal alteration in bone marrow	6
Signal alteration in soft tissue	6
Periarticular abscess formation with thick, irregular enhancing walls	2
Periarticular abscess with thin, smooth enhancing walls	4
Subchondral bone erosion	4

Table 8: Magnetic resonance imaging findings in transient synovitis (total number of cases=3)

MRI findings	Number of patients
Synovial thickening	3
Synovial enhancement	3
Joint effusion (ipsilateral)	3
Joint effusion (contralateral)	1
Bone marrow edema	0
Signal alteration in soft tissue	0

Sacroiliitis

MR findings commonly observed in sacroiliitis are periarticular marrow edema adjacent to sacroiliac joint, changes in cartilage, and subchondral bone erosions.^[8]

In our study, three cases had sacroiliitis, of which two had unilateral and one had bilateral involvement. All were seronegative.

Perthes Disease

In our study of 50 patients, one child of age 7 years with bilateral hip pain was diagnosed as Legg-Calve-Perthes disease which is an idiopathic osteonecrosis of the femoral epiphysis in children. MR features revealed hypointensity on T1-weighted image with focal flattening of articular surface of femoral head in anterior-superior region [Figure 7]. Hochbergs *et al.*^[9] on his study on Perthes disease found similar MR findings.

SCFE

There was one child of 14 years with clinically suspected case of SCFE. MR findings revealed physeal widening, bone marrow edema, retroversion at epiphyseal-metaphyseal junction (on axial image), joint effusion, and positive Trethowan sign (i.e., a line drawn up the lateral edge of the femoral neck fails to intersect the epiphysis on coronal T2-weighted image) [Figure 8]. Similar findings were seen in a study conducted by Umans *et al.*^[10]

Tumors

Chondrosarcoma

An elderly patient of 72 years revealed MR findings of altered marrow signal in the right iliac bone with adjacent large heterogeneously enhancing soft tissue, infiltrating surrounding gluteal muscles [Figure 9]. Histopathology revealed chondrosarcoma. Chondrosarcoma is the common primary malignant sarcoma of bone in adults, usually between 40 and 70 years with male predominance. The most common sites are pelvis, femur, and humerus.^[11]

Chondroblastoma

Chondroblastoma is the rare benign cartilaginous neoplasms that characteristically arise in the epiphysis or apophysis of a long bone in skeletally immature patients. In our study, MRI findings in a female child of 14 years revealed a well-defined lobulated T1 hypointense and T2/STIR intermediate signal intensity lesion in epiphyseal region of the right femoral head with adjacent STIR hyperintense marrow edema [Figure 10]. The diagnosis of chondroblastoma was given, which was further confirmed by biopsy.

Metastasis

In our studies, two patients were diagnosed as bony metastasis. One female (45 years) with a history of breast



Figure 13: Axial T2-weighted image shows expansile lesion in the left acetabulum with multiple blood-fluid levels, consistent with findings of aneurysmal bone cyst which was further confirmed by biopsy

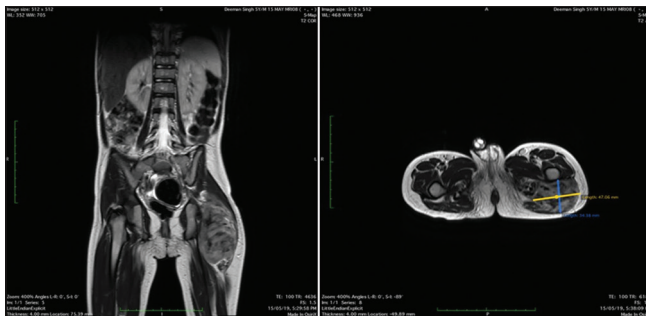


Figure 14: T2 coronal and axial images show heterogeneously T2 hyperintense soft tissue mass involving surrounding muscles of the left hip joint, underlying bones were spared. Diagnosis of soft tissue sarcoma was given, biopsy proved it to be rhabdomyosarcoma

malignancy with hip pain was referred for MRI hip, which revealed expansile altered marrow signal intensity involving left ilium bone associated with multiple areas of cortical breach and adjoining soft tissue component. Multifocal T2/STIR hyperintense lesions were also seen in pelvic bone, bilateral proximal femur, and lower lumbar vertebrae [Figure 11].

Another patient with a history of carcinoma prostate (58 years) also revealed multiple variable sized T1 hypointense and T2 hyperintense lesions in pelvic bone. MRI has high sensitivity and specificity for detection of skeletal metastasis.

Multiple myeloma

We had one patient of multiple myeloma associated with hip pain. MR findings depicted multiple discrete and confluent variable sized T1 hypointense and T2 hyperintense lesions showing post-contrast enhancement in bilateral proximal femurs, pelvis, lumbar, and sacral vertebrae [Figure 12].

Aneurysmal bone cyst

One 19-year-old male child, with clinically suspected case of tubercular arthritis, was referred for MRI hip, which revealed well-defined expansile lesion in the left acetabulum bone with T1 hypointense and T2/STIR hyperintense signal intensity with multiple blood-fluid levels [Figure 13]. These imaging findings of aneurysmal bone cyst were further confirmed by biopsy.

Soft tissue sarcoma

They are a heterogeneous group of malignant tumors of mesenchymal origin, which originates from soft tissues rather than bone. One 5-year-old child, with the left hip pain associated with swelling, was imaged. MRI findings revealed heterogeneously T2 hyperintense soft tissue mass involving surrounding muscles of the left hip joint, underlying bones were spared [Figure 14]. Diagnosis of soft tissue sarcoma was given, biopsy proved it to be rhabdomyosarcoma (subtype of soft tissue sarcoma), which is common in pediatric population.

CONCLUSION

MRI of the hip joint is non-invasive, non-ionizing, safe, and accurate imaging modality of choice for diagnosing various causes of hip pain. Due to its excellent soft tissue resolution and multiplanar imaging capability, it can delineate various hip pathologies and help in early diagnosis where radiograph appears normal. We diagnosed wide spectrum of MR findings in patients with all age groups in patients with hip pain. The various underlying conditions included AVN, infective arthritis, transient synovitis, sacroiliitis, osteoarthritis, SCFE, Perthes disease, and tumors.

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To Compare the Effectiveness of Sub-Tenon's Anesthesia with Peribulbar Anesthesia in Patients Undergoing Manual Small-incision Cataract Surgery

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Abstract

Background: Blindness due to cataract presents an enormous problem in terms of human morbidity, economical loss, and social burden. Retrobulbar anesthesia was commonly used for cataract surgery. Rare but serious complications led many ophthalmologists to replace retrobulbar with peribulbar anesthesia. However, even peribulbar anesthesia does not eliminate the serious complications totally. These concerns have led to increased use of blunt needle sub-Tenon's block over the sharp needle blocks.

Materials and Methods: 200 cases were selected, of which 100 were in the sub-Tenon's group and the remaining 100 were in the peribulbar group. The efficacy of anesthesia between the two groups was compared in terms of analgesia at various intervals, akinesia of the globe and eyelids attained after the block. They were graded on a subjective scale and recorded. Minor complications such as chemosis, sub-conjunctival hemorrhage, and rise in increased intraocular pressure (IOP) were also compared and analyzed.

Results: Sub-Tenon's anesthesia provided better analgesia than peribulbar anesthesia although the akinesia was poorer than the latter. Minor complications such as sub-conjunctival hemorrhage were more in sub-Tenon's group while instantaneous rise in IOP was more in peribulbar group. The incidence of chemosis was almost comparable in both the groups.

Interpretation and Conclusion: Sub-Tenon's anesthesia is recommended as a safe and effective alternative to peribulbar anesthesia for small-incision cataract surgery as it provides good analgesia, adequate akinesia, and rare minor complications.

Key words: Akinesia, Analgesia, Chemosis, Intraocular pressure, Local anesthesia, Manual small-incision cataract surgery, Peribulbar anesthesia, Subconjunctival hemorrhage, Sub-Tenon's anesthesia

INTRODUCTION

The most common elective ophthalmic surgery done under local anesthesia is cataract surgery.^[1] Manual small-incision cataract surgery (MSICS) is a low budget procedure suitable for developing countries because of the lesser magnitude of reliance on machine and broader

applicability. Its safety and easy learning curve are its add-on plus point.

Previously retrobulbar anesthesia was commonly used for MSICS, but the associated complications led to the discovery of a low-risk surrogate which is peribulbar anesthesia. However, peribulbar anesthesia has its own snag and constraints.^[2] Multiple compartments in the orbit lead to patchy and non-equivalent spread of local anesthetic.^[3] This accounts for inferior blocks, the need for multiple injections, or very large injected volumes.^[4]

Furthermore, the drawback of being a sharp needle procedure and its associations with retinal hemorrhage, globe perforations, central retinal hemorrhage, and rarely,

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death have been reported.^[5,6] This led to the development of sub-Tenon's block, which results in less pain and less unfavorable incidents when compared to peribulbar block.^[7,8]

Sub-Tenon's anesthesia, also known as pinpoint anesthesia, parabolbar block or episcleral block is a blunt needle approach which is simple, safe, and effective for ocular surgeries such as conventional extracapsular cataract extraction, MSICS, phacoemulsification, panretinal photocoagulation, trabeculectomy, and strabismus surgery, especially in patients with a single eye, glaucomatous eye, and in old patients with poor cardiac function.^[1,8,9]

Sub-Tenon's anesthesia eliminates injury to retinal vasculature, optic nerve and globe and provides better anesthesia to ocular surgeries without drawbacks of topical anesthesia.

Therefore, an attempt is made to compare the efficacy of sub-Tenon's with peribulbar anesthesia in MSICS using randomized controlled trial.

MATERIALS AND METHODS

This study was conducted in the Department of Ophthalmology, Rajarajeswari Medical College and Hospital, Kambipura, Bengaluru, from August 2017 to August 2018. All patients in the age group of 30–90 years, with a visual acuity of >6/12 with no pinhole improvement and undergoing MSICS were eligible for the study after physical fitness for surgery was given by the physician. Patients with pre-existing ocular muscle paresis or neurological deficits, co-existing infective or any other inflammatory condition, with history of ocular trauma, subluxated lens, sensitivity to lignocaine and/or bupivacaine, pupil size <5 mm and patients who opted for and/or required general anesthesia were excluded from the study. 200 cases were enrolled for the study with 100 cases in the sub-Tenon's group (Group A) and 100 cases in the peribulbar group (Group B). Ethical committee clearance obtained from the institutional review board. All patients were in-patients of the hospital. Informed consent was obtained from all the patients for the surgery and the anesthetic procedure.

Detailed history and ocular examination (vision testing, slit-lamp biomicroscopic examination, tonometry, lacrimal sac syringing, fundus examination, A-scan biometry, and B-scan ultrasonography) were done. Pre-operative preparation was done with moxifloxacin eye drops, tropicamide 0.5% and flurbiprofen 0.03%. Anesthetic mixture was prepared using 1 vial injection hyaluronidase containing 1500 IU, 20 ml vial

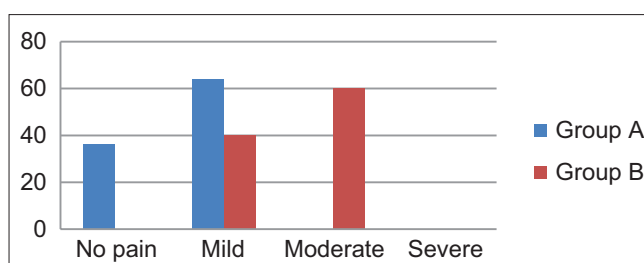


Figure 1: Analgesia at the time of administration of block

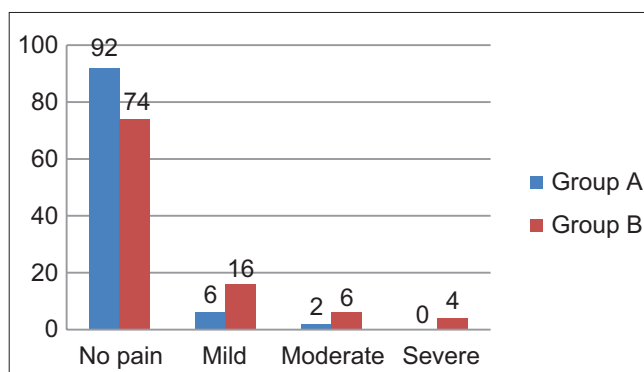


Figure 2: Analgesia during intra operative duration

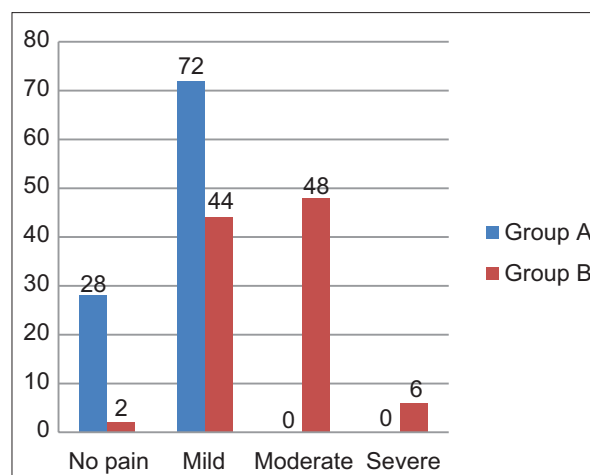


Figure 3: Analgesia 4 h post operatively

containing 2% lignocaine and (1:200,000) adrenaline, and 20 ml vial containing 0.5% bupivacaine. Sensitivity to the local anesthetic mixture was tested. The eye to be operated was cleaned with 10% povidone-iodine solution and after 5 min the anesthetic block given.

Sub-Tenon's anesthesia was given after topical instillation of 0.5% proparacaine followed by insertion of universal eye speculum to expose inferonasal quadrant and a small tent of conjunctiva raised and incised. Sub-Tenon's capsule was dissected by blunt dissection and 3 ml of local anesthetic mixture was injected slowly using a curved blunt irrigating cannula (23G, 25 mm) introduced along the contour of the globe until the tip passes beyond the equator. Peribulbar

Table 1: Demographic distribution of the study population

Feature	Group S		Group P		P-value
Age distribution	62.11±9.73		60.48±9.38		0.229
Gender distribution	Male	Female	Male	Female	0.886
	58	42	57	43	
Diagnosis	IMC	MC	IMC	MC	0.817
	73	26	69	30	
Laterality	Left eye	Right eye	Left eye	Right eye	0.773
	39	61	49	51	

IMC: Immature cataract, MC: Mature cataract, HMC: Hypermature cataract

Table 2: Grading of analgesia achieved among the study population

Analgesia	Group S	Group P	P-value
At the time of administration of block			
No pain	36	0	<0.001
Mild	64	40	
Moderate	0	60	
Severe	0	0	
Intra operative			
No pain	92	74	0.004
Mild	6	16	
Moderate	2	6	
Severe	0	4	
4 h post-operative			
No pain	28	2	<0.001
Mild	72	44	
Moderate	0	48	
Severe	0	6	

Table 3: Akinesia of eyeball and eyelid achieved among the study group

	Group A	Group B	P-value
Akinesia of globe			
Complete movement remaining	40	0	<0.001
Moderate movement	50	6	
Slight movement	10	32	
No movement	0	62	
Akinesia of lids			
Normal	4	0	0.007
Reduced movements	26	14	
No movements	70	86	

anesthesia was given with a 24G needle inserted at the junction of outer and middle third of the inferior orbital margin (2.5 cm depth) parallel to the floor of the orbit where 4 ml of the local anesthetic mixture was injected. Eyelid closed and ocular massage applied for 3–4 min. For patients who did not develop satisfactory akinesia, a supplementary superonasal injection was given.

The efficacy of sub-Tenon's versus peribulbar anesthesia with regard to pain during needle insertion, intraoperative pain, pain in the immediate 4 h post-operative period, akinesia of the globe, and eyelids during surgery were compared. The rate of complications such as rise in increased intraocular pressure (IOP), subconjunctival

Table 4: Mean IOP distribution among the study population at different time intervals

IOP (mmHg)	Group S	Group P	P-value
At the time of block	16.41±2.79	16.20±2.36	0.563
1 min after block	18.83±2.77	20.61±2.43	<0.001
10 min after block	17.49±2.75	17.52±2.42	0.950

IOP: Increased intraocular pressure

Table 5: Conjunctival chemosis and sub conjunctival hemorrhage seen in the study group

	Group A	Group B	P-value
Conjunctival chemosis			
No chemosis	61	64	0.133
Chemosis in 1 quadrant	29	20	
Chemosis in 2 quadrant	6	14	
Chemosis in 3 or 4 quadrants	4	2	
Sub conjunctival hemorrhage			
No hemorrhage	44	64	0.003
Hemorrhage in 1 quadrant	46	22	
Hemorrhage in 2 quadrant	8	12	
Hemorrhage in 3 or 4 quadrant	2	2	

hemorrhage, and conjunctival chemosis after administration of the block was assessed. Significance was assessed at 5% level of significance. Student *t*-test and Chi-square/Fisher's exact test were used for statistical analysis.

DISCUSSION

In this ever-changing medical field, age wherein retrobulbar was most popular is replaced by safer alternatives. Need for safer alternatives has introduced the ophthalmic society to peribulbar anesthesia and sub-Tenon's anesthesia and much more recently to topical application technique. Several studies have been done on sub-Tenon's anesthesia since its introduction in 1992. In this study, we have made an attempt to compare the efficacy of sub-Tenon's anesthesia with peribulbar anesthesia. A total of 200 cases fulfilling the inclusion criteria were identified. They were divided into two groups: Group S receiving sub-Tenon's anesthesia and Group P receiving peribulbar anesthesia, with 100 cases each. The distribution of study population in both groups were comparable [Table 1].

Pain assessment was our primary objective and it was graded by a subjective scoring with Grade 0 as no pain and grade 3 as severe or intense pain. In our study more number of patients receiving peribulbar block had higher grading of pain during administration of block, during intraoperative period and after 4 hours post surgery which was statistically significant ($P < 0.001$) when compared with the sub tenons group [Figures 1-3 and Table 2]. In spite of higher grades with peribulbar group none of the patients required any additional anaesthesia during the surgery.^[10]

Narendra P Datti *et al.* compared sub tenons and peribulbar anaesthesia technique in 500 patients. They concluded that sub tenons anaesthetic technique was better.^[13] Also El Sherbeny et al had statistically significant difference in pain when sub tenons was compared with peri bulbar and concluded that sub tenons anaesthesia was superior.^[11]

The intraoperative eyeball movements and lid movements were significantly less in cases who received peribulbar block.^[12] There was no such significant IOP rise in cases receiving sub-tenon's block [Table 3].^[14] There was significant rise in intraocular pressure one minute after administration of the peribulbar block, but it came down to basal levels within 5 minutes [Table 4].^[15] The rate of conjunctival chemosis was similar in both groups but the incidence of sub-conjunctival hemorrhage was significantly higher in cases receiving sub-tenon's block [Table 5].^[16]

The only comparison that was not recognized and included in the initial part of our study was the difficulty in the operative procedure faced by the surgeon. However, since all the surgeries were not performed by a single surgeon, not including the comparison would be easy to defend.

CONCLUSION

Sub-Tenon's anesthesia is adept for MSICS in comparison with peribulbar anesthesia as it provides good analgesia, adequate akinesia and causes only rare, minor and inconsequential complications. Furthermore, the quantity of anesthetic mixture used in sub-Tenon's anesthesia is inferior when compared to peribulbar anesthesia. Hence, sub-Tenon's anesthesia appears to be a reasonable bargain and cost efficient in our country where organizations cater to a large number of deprived population.

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Reconstructive Options in Head-and-Neck Cancer Surgeries

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Abstract

Introduction: Surgery is the standard treatment to achieve cancer control, but due to socioeconomic and other factors, most patients present with a locally advanced tumor leading to extensive resection of mucosa, muscle, bone, and skin. Reconstruction of these defects is essential not only in ensuring function and cosmesis but also in enabling the start and completion of adjuvant therapy on time.

Aim: The study aims to analyze the various reconstruction methods used in the head-and-neck cancer surgery.

Materials and Methods: Various cancers of the head and neck using various reconstruction options such as primary closure, local flaps, and regional flaps. Pre-operative radiotherapy, extent of defect, the type of reconstruction used, post-operative complications, and the functional outcome in the immediate post-operative period, 1 month after surgery, and at 6 months were recorded.

Results: Of the 180 surgeries for head-and-neck cancers, primary closure was done in 79 cases. Other reconstruction options used were pedicled regional flaps – 75, local flaps – 11, and split skin grafting – 15. Of the 79 primary closures, 2 cases of infection, 2 cases of partial necrosis (neck skin and tongue), 8 cases of minor wound dehiscence, and 2 cases of fistulae of which one was chylous were noted. Of the 50 pectoralis major myocutaneous (PMMC) flaps, 29 were for lining the oral/oropharyngeal cavities, 6 were for cover the skin defects, and 15 were for both lining and cover.

Conclusion: PMMC is the choice flap in high-volume centers with resource and time constraints where microsurgical expertise is not available. They have proved effective in the absence of microvascular free flaps. Further improvement in our results can be achieved if free flaps could be used in a choice few cases and effective mandibular reconstructions are to be used.

Key words: Head-and-neck cancer, Microvascular free flaps, Reconstruction

INTRODUCTION

Head-and-neck cancer represents the sixth most frequent malignancies. Worldwide, more than 500,000 new cases are diagnosed annually, along with 300,000 deaths. Head-and-neck cancer predominantly affects men, with a male:female ratio of up to 10:1. There is also an increased risk of developing this type of cancer.^[1,2]

Head-and-neck cancer surgery entails a range of surgery from simple primary closure to complex reconstruction

requiring free flaps. Several flaps, including the anterolateral thigh, fibula osteocutaneous, and suprafascial radial forearm fasciocutaneous free flaps, have emerged as workhorse flaps for reconstructing a wide variety of defects. As the anatomy of these flaps has become more familiar, their reliability and versatility have increased. Reliable wound closure without exposure to vital structures is no longer the only priority.^[3,4] It is prudent to follow an order of reconstruction using the simplest that suits the requirement. Excision of head-and-neck tumors may result in the exposure of vital structures such as the brain, eye, aerodigestive tract, or major neurovascular structures. If inadequately reconstructed, such defects may result in significant complications and/or impairment in the performance of routine daily functions, such as speech and swallowing. In addition, esthetic disfigurement may be very significant to the patient's self-image and social adaptability. Adequate reconstruction after tumor excision is, therefore, the first step to rehabilitating the head-

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and-neck cancer patient, aiming to preserve and restore pre-operative activity and quality of life.^[5]

Aim

The study aims to analyze the various reconstruction methods used in the head-and-neck cancer surgery.

MATERIALS AND METHODS

A total of 180 surgeries were done for various cancers of the head and neck using various reconstruction options such as primary closure, local flaps, and regional flaps in the Department of Surgical Oncology at Tirunelveli Medical College Hospital from January 2016 to June 2019. Some patients had more than one type of reconstruction in the same or subsequent surgery. A common pro forma incorporating the details such as name, age, sex, diagnosis, comorbid conditions, pre-operative radiotherapy (RT), extent of defect, the type of reconstruction used, post-operative complications, and the functional outcome in the immediate post-operative period, 1 month after surgery, and at 6 months was noted in all cases involving major oral cavity resections as applicable. The surgeries were analyzed as to the outcome of each method.

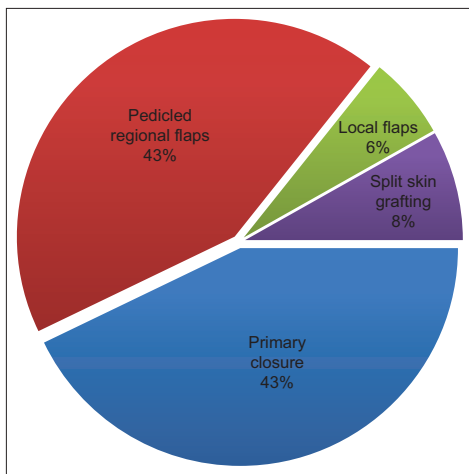


Figure 1: Types of reconstructions used

Royapettah Scoring System

A scoring system devised by our parent institute at Government Royapettah Hospital, Chennai, to assess the post-operative outcome of our major oral resections incorporating both functional (chewing, speech, and swallowing) and cosmetic aspects has been applied to all cases, and the outcome was assessed. A score of 17 or more was considered satisfactory.

RESULTS

Of the 180 surgeries for head-and-neck cancers, primary closure was done in 79 cases [Figure 1].

Split Skin Graft (SSG)

Fifteen skin/mucosal defects were closed with SSG. Small mucosal defects after resection of buccal, tongue, and floor of the mouth (FOM) cancers can be reconstructed with SSG. Three cases had partial necrosis and three cases had complete necrosis.

Local Flaps

Among the four nasolabial flaps, all were for skin cancers. Two tongue flaps were used, one each for defects of FOM and lower alveolus defects. Both were posteriorly based and healed without any significant morbidity. Five local rotation flaps were used for skin cancer and parotid defects. One patient had partial necrosis salvaged by SSG.

Forehead Flap

The forehead flap has been routinely used for closing full-thickness cheek defects of eight cases, two had partial necrosis, and one had fistula.

Deltpectoral (DP) Flap

DP flaps were used in eight cases mostly to provide skin cover in two cases, and DP was used in conjunction with pectoralis major myocutaneous (PMMC). In two cases, DP was used for parotid region 1 case each for skin defects in the neck following submandibular tumor resection and flap necrosis complicating chylous fistula.

Table 1: Significant post-operative complications

Reconstruction	Gross infection	Partial necrosis	Complete necrosis	Dehiscence	Sinus fistula
Pectoralis major myocutaneous	7	17	-	17	17
Forehead	1	2	-	-	1
Nasolabial	-	-	-	-	-
Latissimus dorsi	-	1	1	1	1
Deltpectoral	-	-	-	-	-
Pericranial	-	-	-	-	-
Local	-	-	1	-	-
Stomach	-	-	-	1	1
Split skin graft	-	3	3	-	-
Primary closure	2	2	-	8	1

No post-operative complications were encountered in any of the flaps.

PMMC Flap

Of the 50 flaps, 29 were for lining the oral/oropharyngeal cavities, 6 were for cover the skin defects, and 15 were for both lining and cover by bipaddling the flap. There were 7 cases of gross infection, 17 – partial necrosis, 17 – dehiscence, and 17 – fistula. Four cases of secondary hemorrhage due to carotid blowout occurred leading to a major complication of 31% and overall complication rate of 52%; two cases required major surgical intervention such as latissimus dorsi (LD) flap. Others were managed conservatively [Tables 1 and 2].

LD Flap

Of the four cases reconstructed, two had no complications. one patient had to be taken up for LD flap as PMMC flap

Table 2: Various factors in pectoralis major myocutaneous

Necrosis	Yes	No	P value
Age >60 years	6	7	0.375
Male	14	26	0.768
Diabetes mellitus	6	8	0.528
Radiotherapy	12	20	0.768
Palato-alveolar resection	3	4	0.683
Bipaddled	8	5	0.025

raising had to be abandoned midway because of inanition and poor pectoralis major muscle bulk. This flap was partially necrosed and fistula formed. One patient had partial necrosis of previous PMMC, and LD was applied. This patient had recurrent cancer buccal mucosa where both DP and forehead flaps had already been used and so LD was chosen. LD flap necrosed completely on the 2nd post-operative day. The patient was discharged for microvascular repair elsewhere.

Gastric Transposition

All the four cases were for pharyngo-laryngo-esophagectomy. One case developed wound dehiscence and fistula. One case developed secondary hemorrhage and expired in the post-operative period.

Pericranial Flaps

There were two anterior craniofacial resections – recurrent cancer of the right eyelid involving the skull base and another case of post-RT residual nasal cavity transitional cell carcinoma. Both patients had the closure of the anterior skull base by the use of dural and pericranial flaps; both healed well without complication [Figure 2].

Royapettah Scoring System

A total of 36 patients had satisfactory Royapettah scale score. Fourteen patients had a score of <17. Only

Table 3: Royapettah scoring system

Pain	Nil (5)	Rare (3)	Modest (1)	Severe (0)
Mouth opening	Normal	Trismus+	++	+++
Oral closure	Blows	Holds food	Rare spill	Drools saliva
Occlusion	Hard bite	Chews solids	Soft boiled	Liquids
Phonation	Normal	Few syllable difficult	Audible	Not audible
Swallowing	Normal	Avoids certain food	Rare regurgitation	Aspirates
Cosmetic/social acceptance	Resumes work enthusiastic	Adapts work satisfied	Socializes accepts	Confined dislikes

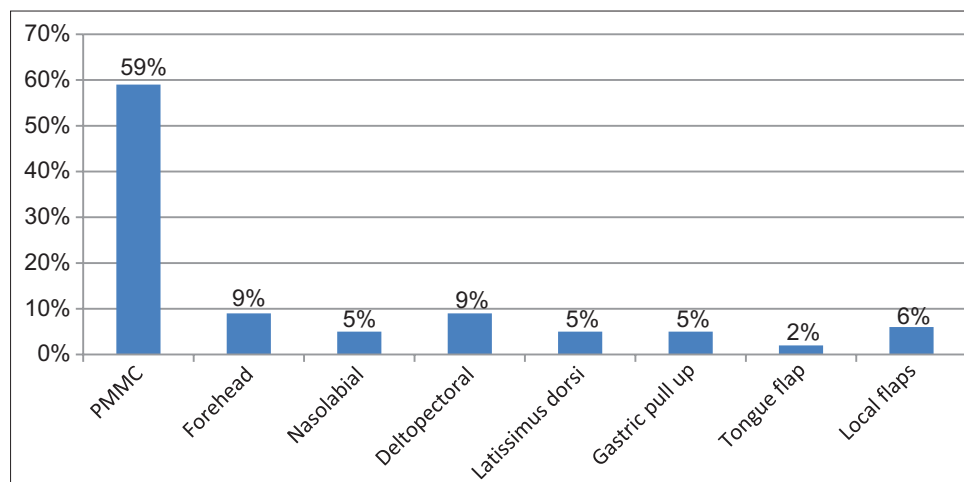


Figure 2: Various flaps used

diabetes mellitus was associated with the outcome measure in a statistically significant manner ($P = 0.004$) [Tables 3 and 4].

DISCUSSION

For head-and-neck reconstruction, the skin between the nipple and midline based on the pectoralis major muscle is used, depending on the distance between the pivot point of the flap (the midclavicular point) and the recipient site. The thoracoacromial artery descends from its origin from the subclavian artery at the level of the midclavicular point in an inferomedial direction and anastomoses within the muscle with the direct branches of the internal mammary artery and anterior intercostal branches of the internal mammary artery. The branches to the skin are spread in the fourth, fifth, and sixth intercostal spaces. When the flap is raised on the thoracoacromial artery, the skin paddle receives blood from the direct musculocutaneous branches of the thoracoacromial artery as well as from the musculocutaneous branches of the intercostal artery via the rich anastomotic network within the muscle with the thoracoacromial artery. In elevating over 300 PMMC flaps, the authors noticed that the perforating branches to the skin paddle area used for head-and-neck reconstruction are located in three distinct places (designated P1, P2, and P3) – P1: Along the medial edge of the muscle, direct musculocutaneous branches from the internal mammary artery (similar to the DP flap perforators); P2: 2–4 cm medial to the nipple, coming from the anterior intercostal branch of the internal mammary artery, as elaborately described

by Kiyokawa *et al.* and P3: Fine branches are reaching the skin by curving around the lateral border of the muscle. In addition, some branches of the lateral thoracic artery are found in the skin lateral to the nipple at the level of the fourth rib. Because of the rich anastomotic network within the muscle, the blood supply from the acromiothoracic artery safely reaches the skin even after ligation of the branches of the internal mammary artery and the lateral thoracic artery.^[6-8]

The most dreaded complication of the PMMC flap is the loss of the flap. This unfortunate event is often a consequence of a technical mistake in either the harvesting of the flap or on the inset. When harvesting the flap, care must be taken to avoid the shearing forces on the skin paddle from the underlying muscle. The placement of significant forces will cause disruption of the perforating vessels to the overlying skin and potentially lead to the loss of the skin paddle. Another reason for the eventual loss of the skin paddle due to a technical mistake during harvest is the undermining of the skin leading to a larger skin island over a small base of fat connecting to the muscle. In these cases, the lateral edges of the unsupported skin may not be perfused and could potentially become ischemic later. Technical mistakes can also be made at the time of the inset, which can lead to the loss of the flap. In this scenario, the most common culprit is the closure of the flap under significant tension. In cases where there is tension on closure, the shoulder roll should be taken out allowing the shoulder to drop, and at the same time, the neck should be flexed to further diminish the distance from the donor site and the reach of the flap. Once this is done, the tension should be relieved, and the closure should be performed in a safer manner. Complications can also occur at the donor site. The most commonly seen complications in this region are: formation of a hematoma, dehiscence of the wound closure, loss of alignment of the breast as it relates to the contralateral breast, ischemia of the skin, and the formation of a seroma [Table 5].^[9,10]

Table 4: Royapettah scoring system

Ramsay sedation scale score >17	Yes	No	P value
Age >60 years	8	5	0.328
Male	28	12	0.528
Diabetes mellitus	6	8	0.004
Radiotherapy	21	11	0.18
Palato-alveolar resection	6	1	0.383
Bipaddled	10	1	0.645

Table 5: Comparison study results with literature

Study	Type of flap	Number of cases	Major complication	Overall complication
Ahmad <i>et al.</i> , Tata Memorial Hospital, Mumbai ^[6]	PMMC	47	2.1% complete loss	30%
Wadwongtham <i>et al.</i> , Bangkok. ^[11]	PMMC	93	17.70%	54.20%
Milenović <i>et al.</i> ^[12]	PMMC	506	17%	33%
Koh <i>et al.</i> , Seoul ^[13]	PMMC	34	6%	Not mentioned
Feng <i>et al.</i> , Taiwan ^[14]	DP	34	Nil	7%
Our study	PMMC	50	31%	52%
Our study	DP	8	Nil	Nil

PMMC: Pectoralis major myocutaneous, DP: Deltopectoral

CONCLUSION

Head-and-neck cancer surgeries require various reconstruction methods ranging from the simplest to the complex. Reconstruction is to be tailored according to the needs of the individual case. Pedicled regional flaps, especially PMMC, have been the workhorse in our hospital. Most of the complex oral and oropharyngeal resections can be effectively managed with PMMC without any expert plastic surgical help. They can be monitored easily postoperatively without any need for sophisticated methods for free flaps. PMMC is the choice flap in high-volume centers with resource and time constraints where microsurgical expertise is not available. They have proved effective in the absence of microvascular free flaps. Further improvement in our results can be achieved if free flaps could be used in a choice few cases and effective mandibular reconstructions are to be used.

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Study on Treatment and Outcome of Patients with Guillain–Barre Syndrome – A Prospective Study

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Abstract

Introduction: The history of Guillain–Barre syndrome (GBS) runs parallel with the discovery of the peripheral nervous system. Up to the second half of the 19th century, injury to the peripheral nervous system had not yet emerged as a possible cause of palsy.

Aim: This study aims to study the treatment and outcome in patients with various subtypes of GBS.

Materials and Methods: Patients who had been admitted with the diagnosis of GBS based on Asbury's criteria which included ascending areflexic quadriparesis, with or without cranial nerve dysfunction, and evolving within a period of 4 weeks. We also included patients who presented with features of GBS subtypes without prominent weakness. A detailed history and physical examination as per a structured pro forma were taken and necessary laboratory investigations were done.

Results: Twenty-five patients were admitted with disability grade of >3 in GBS disability scale (>5 in Medical Research Council disability scale) and 18 were admitted below the score. Sixteen patients needed ventilator support and 10 patients expired. Among the 22 patients who were treated with intravenous immunoglobulin (IVIg), 14 patients (24.6%) had a good outcome and 8 patients (14.0%) had a poor outcome. Among the nine patients who were treated with plasma exchange, six patients had a good outcome and three had a poor outcome. Among the 19 patients, who were treated with injection methylprednisolone, eight patients had a good outcome and 11 patients had a poor outcome. The values obtained are not statistically significant ($P = 0.076$).

Conclusion: The mean improvement in GBS disability scale from admission to the end of the 8th week is more for IVIg-treated patients when compared to methylprednisolone-treated group.

Key words: Guillain–Barre syndrome, Life threatening, Outcome

INTRODUCTION

Guillain–Barre syndrome (GBS) is an acute, self-limited, inflammatory, autoimmune disorder of the peripheral nervous system triggered usually by a bacterial or viral infection or other antecedent events.^[1] It affects 0.9–2/100,000 persons in a year, with a worldwide distribution and a slight male preponderance.^[2] In general, at the end of 1 year of illness, 5% of the patients had expired and 15% might be unable to walk. Hence, it causes a large loss of productivity and burdens health care due to its

prolonged morbidity. It is a heterogeneous disorder in its type, severity, pathogenesis, and prognosis. GBS is characterized by rapidly progressive weakness of all four limbs with or without sensory loss, evolving within 4 weeks followed later by slow clinical and electrophysiological recovery.^[3,4] The subtypes of GBS are several. Among those who produce weakness, the common one is acute inflammatory demyelinating polyradiculopathy (AIDP), acute motor-sensory axonal neuropathy (AMSAN), and acute motor axonal neuropathy (AMAN) and the rare one are pharyngo-cervico-brachial variant, bilateral foot drop, and bifacial weakness. Among those who do not produce weakness, the common one is Miller-Fisher syndrome (MFS) and the rare ones are pure sensory variant and acral paresthesias with areflexia.^[1]

Neurophysiologic abnormalities are often very mild or occasionally normal in the early stages of GBS and hence may not correlate well with clinical disability. AIDP is

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characterized classically by conduction block with also prolongation of compound muscle action potential (CMAP) latency and F-wave latency but a normal amplitude. AMAN and AMSAN are characterized by reduction or absence of amplitude of CMAP and both CMAP and sensory nerve action potential, respectively.^[5]

Experimental evidence implicates autoantibodies to gangliosides as the cause of the axonal subgroup of GBS and MFS. These antibodies may be generated by the immune response to an infective organism such as *Campylobacter jejuni*, cross-reacting with the epitopes on the axon. The resemblance of AIDP to experimental autoimmune neuritis suggests pathogenetic mechanisms involving T-cell induced macrophage-associated demyelination. This proposed autoimmune etiology leads to the induction of immunotherapy.^[6]

Aim

This study aims to study the treatment and outcome in patients with various subtypes of GBS.

MATERIALS AND METHODS

This is a prospective study, conducted in patients who had been admitted with the diagnosis of GBS, in the medical, neuromedical, emergency medical, or intensive medical care ward in a tertiary care hospital.

Table 1: Severity of disability with which patient presented

GBS	Frequency	<3 – GBS score <5 – MRC disability scale [19] (30.2%)	>3 – GBS score >5 – MRC disability scale [38] (60.3%)
AIDP	43	18	25
AMSAN	8	-	8
AMAN	3	1	2
Unclassified	3	-	3

GBS: Guillain–Barre syndrome, MRC: Medical Research Council, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy

The inclusion criteria consist of patients who presented with features of GBS based on Asbury's criteria which included ascending areflexic quadriparesis, with or without cranial nerve dysfunction, and evolving within a period of 4 weeks. We also included patients who presented with features of GBS subtypes without prominent weakness.

The exclusion criteria are as follows:

1. Early and prominent bladder and bowel dysfunction
2. Marked and persistent asymmetry of symptoms and signs
3. Presence of persistent sharp sensory level
4. Features of other diseases such as myasthenia gravis, botulism, poliomyelitis, porphyria, and diphtheria
5. Drug or toxin-induced acute neuropathy.

Data regarding the demographic features such as age, sex distribution, and month of occurrence and clinical features such as antecedent illness, the involvement of cranial nerves, and autonomic dysfunction were collected.

During admission, patients were analyzed for their disability using the GBS disability scale and Medical Research Council (MRC) disability scale. For patients with disability grade of >3 in GBS disability scale and for those with progressively increasing weakness, the definite treatment options (intravenous immunoglobulin [IVIg] or plasma exchange) were started. Due to non-availability, some patients received only injection methylprednisolone.

Patients were followed up throughout their stay in the hospital. Intensive medical care was provided for those patients with an advanced stage of the disease. Elective intubation was done for those patients who had poor single breath count estimation and reduced peak expiratory flow rate and for those with neck muscle weakness and poor cough reflex. Ventilatory support was provided for those in need. Tracheostomy was performed on those patients who tend to require ventilatory support for more than 10–14 days.

Periodic assessment of their clinical status and disability was done and their peak disability was noted. At the end of

Table 2: Treatments given for various subtypes of GBS

GBS	Ivlg [22] (34.9%)	Methylprednisolone [25] (39.7%)	Plasma exchange [9] (14.3%)	No. treatment [4] (6.3%)	Not applicable [3] (4.8%)
AIDP [43]	18	15	6	4	-
AMSAN [8]	3	3	2	-	-
AMAN [3]	1	1	1	-	-
MFS [5]	-	5	-	-	-
Pure sens [1]	-	1	-	-	-
Unclassified [3]	-	-	-	-	3

GBS: Guillain–Barre syndrome, Ivlg: Intravenous immunoglobulin, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy, MFS: Miller–Fisher syndrome

8 weeks duration, reassessment was done in their clinical status and prevailing disability score was noted for further analysis.

RESULTS

Of the 63 patients, 20 patients were in the age group below 20 years and 32 patients were in the age group between 20 and 40 years. Regarding the sex distribution, there is a slight male preponderance of 35 males. Twenty-nine patients in the study had a history of antecedent illness preceded by the occurrence of GBS. Upper respiratory infection and diarrhea were noted in each of 13 patients.

In the present study, 25 patients were admitted with disability grade of >3 in GBS disability scale (>5 in MRC disability scale) and 18 were admitted below the score.

Table 3: Subtypes of GBS patients who needed ventilator or ended up in death

GBS	Ventilator [20] (31.7%)	Death [10] (15.9%)
AIDP	13	5
AMSAN	4	2
AMAN	-	-
MFS	-	-
Pure sens	-	-
Unclassified	3	3

GBS: Guillain–Barre syndrome, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy, MFS: Miller–Fisher syndrome

The score is applicable for the GBS subtypes which cause weakness Table 1.

Treatments Given for Subtypes

In our study, IvIg was given to 18 patients, plasma exchange was given for nine patients, and injection methylprednisolone was given for 25 patients. No specific treatment was provided for four patients who presented with a very minimal disability and they improved spontaneously. Three patients in the study presented in a very acute form, with severe disability scores and died before any specific form of treatment were initiated Table 2.

Subtypes of GBS Patients Who Needed Ventilator or Ended Up in Death

In the present study, 16 patients needed ventilator support and 10 patients expired. Both the need for ventilator support and occurrence of death are noted in AIDP and AMSAN group and in those patients who presented with the very severe form of illness (a fulminant form of illness) Table 3.

Among the 63 patients, death was the outcome for 10 patients.

Twenty patients in our study needed ventilator support at some time during the course of hospital stay. Conventionally, considered poor prognostic factors not only influence death but also lead to a poor respiratory function requiring ventilatory support Tables 4 and 5.

Table 4: The poor prognosticators associated with the patients who had expired

GBS	%	Ventilator [10]	Autonomic disturbance [9]	Peak of weakness ≤8 days [10]	Bulbar dysfunction [9]	Elderly population [2]	High-grade disability* at presentation [9]	Diarrhea [4]
AIDP [5]	11.6	5	4	5	3	2	4	2
AMSAN [2]	25	2	2	2	1	-	2	1
AMAN [0]	-	-	-	-	-	-	-	-
MFS [0]	-	-	-	-	-	-	-	-
Pure sens [0]	-	-	-	-	-	-	-	-
Unclassified [3]	100	3	3	3	3	-	1	1

*>3 scores in GBS disability grading; >5 scores in MRC disability grading. AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy, MFS: Miller–Fisher syndrome

Table 5: The poor prognosticators associated with the patients who required ventilatory support

GBS	%	Death [10]	Autonomic disturbance [13]	Bulbar dysfunction [9]	Peak disability reached <8 days [16]	Elderly [2]	High-grade disability at presentation* [19]	Diarrhea [7]	Tracheostomy [5]
AIDP [13]	30	4	8	5	10	2	12	4	5
AMSAN [4]	50	2	3	1	3	-	4	2	0
AMAN	-	-	-	-	-	-	-	-	-
MFS	-	-	-	-	-	-	-	-	-
Pure sens	-	-	-	-	-	-	-	-	-
Unclassified [3]	10	3	2	3	3	-	1	1	0

*>3 scores in GBS disability grading; >5 scores in MRC disability grading. AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy, MFS: Miller–Fisher syndrome

Table 6: Outcome related events for patients with poor prognostic factors

Prognostic factors	Death	Ventilator dependence	Tracheostomy	Poor outcome*	Good outcome**
Bulbar±Facial weakness, $P=0.002^{\#}$					
AIDP [21]	4	10	4	11	10
AMSAN [2]	1	1	-	2	-
AMAN [1]	1	-	-	1	-
Unclassified [3]	3	3	-	3	-
Autonomic dysfunction, $P=0.029^{\#}$					
AIDP [17]	4	6	2	8	9
AMSAN [5]	2	2	-	3	2
AMAN [1]	-	-	-	1	0
Unclassified [2]	2	2	-	2	0
Diarrhea, $P=0.165^{\#}$					
AIDP [8]	2	4	3	6	2
AMSAN [2]	1	2	-	2	-
AMAN [2]	-	-	-	-	2
Unclassified [1]	1	1	-	1	-
Peak disability reached within 8 days, $P=0.044^{\#}$					
AIDP [22]	5	8	2	11	11
AMSAN [6]	2	4	-	3	3
AMAN [3]	-	-	-	2	1
Unclassified [3]	3	3	-	3	-
Presented with a severe form of disability, $P=0.001^{\#}$					
AIDP [24]	4	12	5	12	12
AMSAN [8]	2	4	-	4	4
AMAN [2]	-	-	-	1	1
Unclassified [3]	3	3	-	3	-

* >3 scores in GBS disability grading; ** ≤ 3 scores in GBS disability grading; >5 scores in MRC disability grading; ≤ 5 scores in MRC disability grading; $^{\#}$ Significance of influence of prognostic factors for poor outcome. GBS: Guillain–Barre syndrome, MRC: Medical Research Council, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy

Table 7: Treatment adopted in GBS subtypes

GBS	Ivlg	Methylprednisolone	Plasma exchange	Not applicable*	No treatment
AIDP					
Mild disability presentation [18]	6	6	2	-	4
Severe disability presentation [25]	12	9	4	-	-
AMSAN					
Mild disability [0]	-	-	-	-	-
Severe disability [8]	3	3	2	-	-
AMAN					
Mild disability [1]	-	1	-	-	-
Severe disability [2]	1	-	1	-	-
Unclassified					
Mild disability [0]	-	-	-	-	-
Severe disability [3]	-	-	-	3	-

*Not applicable – Patients died on day 1 or 2 before any form of treatments are effective. GBS: Guillain–Barre syndrome, MRC: Medical Research Council, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy, Ivlg: Intravenous immunoglobulin

In the study, the outcome assessment is based on whether the patients attained independent walking which is a good outcome (≤ 3 in GBS disability score and ≤ 5 in MRC disability scale) or did not attain independent walking which is a poor outcome, at the end of 8 weeks.

Among the 18 AIDP patients who were treated, six were from mild disability group and 12 were from severe disability group. Among the 15 AIDP patients who were treated with injection methylprednisolone, nine were from severe disability and six were from mild disability group.

Three AMSAN patients of severe disability were treated with Ivlg and methylprednisolone and two by plasma exchange. All patients in the AMSAN group had presented with a severe disability.

One AMAN patient of severe disability group was treated each with Ivlg and plasma exchange and one with a mild disability was treated with methylprednisolone Tables 6 and 7.

In the group of three patients who presented with the very acute and severe form of illness, no effective treatment was started before they expired.

Table 8: Comparison of treatment adopted with clinical outcome at 8 weeks among GBS subtypes

GBS	Death [7]	Ventilator support [16]	Tracheostomy [5]	Poor outcome [21]	Good outcome [30]
Ivlg [22] $P=0.410^{\#}$					
AIDP [18]	1	5	1	6	12
AMSAN [3]	-	-	-	1	2
AMAN [1]	-	-	-	1	-
Plasma exchange [9] $P=0.687^{\#}$					
AIDP [6]	1	1	-	2	5
AMSAN [2]	1	2	-	1	1
AMAN [1]	-	-	-	-	1
Methylprednisolone [18] $P=0.134^{\#}$					
AIDP [15]	3	7	4	7	8
AMSAN [3]	1	1	-	3	-
AMAN (1)	-	-	-	-	1

$\#$ Significance of influence of treatment options for the outcome. GBS: Guillain–Barre syndrome, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy

Table 9: Comparison of treatment options with clinical outcome at 8 weeks among GBS subtypes who presented with severe disability

GBS	Death	Ventilator	Tracheostomy	Poor outcome	Good outcome
Ivlg					
AIDP [12]	-	4	1	5	7
AMSAN	-	1	-	1	2
AMAN	-	-	-	1	-
Plasma exchange					
AIDP [4]	1	1	-	2	2
AMSAN [2]	1	1	-	1	1
AMAN [1]	-	-	-	-	1
Methylprednisolone					
AIDP [9]	3	6	3	6	3
AMSAN [3]	1	1	-	3	-
AMAN [0]	-	-	-	-	-

GBS: Guillain–Barre syndrome, AIDP: Acute inflammatory demyelinating polyradiculopathy, AMSAN: Acute motor-sensory axonal neuropathy, AMAN: Acute motor axonal neuropathy

Table 10: Mean improvement in disability scores for various treatment options

Disability scale	Treatment option	Total numbers	Mean improvement
GBS disability scale $P=0.002^{\#}$	Ivlg	22	1.09
	Plasma exchange	9	0.67
	Methylprednisolone	19	0.00
	No treatment	4	1.00
	Not applicable	3	-1.00
MRC disability scale $P=0.000^{\#}$	Ivlg	22	2.50
	Plasma exchange	9	1.33
	Methylprednisolone	19	0.42
	No treatment	4	2.00
	Not applicable	3	-1.67

$\#$ Significance of influence of treatment options on mean improvement in disability scores. GBS: Guillain–Barre syndrome, Ivlg: Intravenous immunoglobulin, MRC: Medical Research Council

In the IvIg-treated AIDP group of 18 patients, 12 patients had a good outcome and 6 had a poor outcome. In the plasma exchange-treated AMSAN group of two patients, one each had a good and poor outcome. In the methylprednisolone-treated AIDP group of 15 patients, seven had a poor and eight had

a good outcome, whereas three patients expired and 7 had ventilator support.

In the IvIg-treated AIDP patients (12) who presented with a severe disability, the outcome was poor in five patients and good in seven patients. Ventilator was needed in four patients and one had prolonged ventilatory support.

In the plasma exchange-treated (four) AIDP patients who presented with severe disability, two had poor and two had a good outcome. One patient had expired in this group after ventilator support.

In the methylprednisolone-treated (nine) AIDP patients who presented with a severe disability, the outcome was good for three and poor for six patients Tables 8-10.

DISCUSSION

In our study, IvIg was administered to 22 patients (34.9%), plasma exchange was given to 9 patients (14.3%), and injection methylprednisolone was given to 25 patients (39.6%). As already noted, three patients with a fulminant

form of illness were not able to receive either of these treatment modalities and were also not grouped in any of the GBS subtypes (unclassified in our study).

A total of 19 patients needed ventilatory support which constituted 31.7% of the total admission. In various studies, a similar incidence is noted.^[7,8] Lawn *et al.*^[9] noted that 53% of patients needed ventilatory support, whereas Kalitha *et al.*^[10] noted only in 10% of patients. In the AIDP subtype, 27.9% of patients needed ventilatory support, whereas in the AMSAN type, the need was for 50% of cases.

A total of 10 deaths are recorded in our study which constituted 15.9% of the total admission. Even in well-equipped centers with aggressive intensive care unit care, the mortality is noted to be around 5–10%^[6,7] and 4–15%.^[11,12]

A total of five patients required tracheostomy for the need for prolonged ventilation which constituted 7.9% of the total admission.

The IvIg-treated AIDP patients clearly showed less percentage of death, need for ventilatory support and tracheostomy when compared with methylprednisolone-treated patients, though the values are statistically not significant. The other subtypes and variables are very small and hence cannot be compared.

Among the AIDP patients, who presented with a severe disability at admission,^[13] 12 were treated with IvIg, four with plasma exchange, and nine with methylprednisolone.

The outcome was good for 7 patients (58.3%) and poor for 5 patients (41.6%) in the IvIg-treated group. The outcome was good for two patients and poor for two patients in the plasma exchange-treated group. The outcome was good for 3 patients (33%) and poor for 6 patients (66%).

Among the AMSAN patients, who presented with a severe disability at admission, three each were treated with IvIg and methylprednisolone, and two patients were treated with plasma exchange. The outcome was good for two and poor for one patient, treated with IvIg, whereas all three patients had a poor outcome in methylprednisolone-treated group. Plasma exchange resulted in one good and one poor outcome.

Even in the group of patients who presented with severe disability (>3 in GBS disability score) at admission, among the AIDP patients, the outcome appears to be better for those treated with IvIg compared to methylprednisolone. Among the AMSAN patients also, the outcome is poor for the methylprednisolone treated three patients. The values are statistically not significant.

Among the 12 AIDP patients, who presented with a severe disability at admission and treated with IvIg, one of 12 required tracheostomy (8%) and there was no death in this group.

Among the nine AIDP patients, who presented with a severe disability at admission and treated with injection methylprednisolone, six of nine required tracheostomy (33%) and there were three deaths in this group (33%).

Among the AIDP patients who presented with a severe disability at admission itself, the need for ventilatory support with or without tracheostomy and the death is more in methylprednisolone-treated group than in the IvIg-treated group.

The mean improvement in GBS disability scores from admission to the end of the 8th week was calculated for each treatment modality. For IvIg, it is 1.09; for plasma exchange, it is 0.67; and for methylprednisolone, it is 0.00. The values are statistically significant ($P = 0.02$).

Similarly, the mean improvement in MRC disability scores from admission to the end of the 8th week was calculated. For IvIg, it is 2.05; for plasma exchange, it is 1.33; and for methylprednisolone, it is 0.42. The values are statistically significant ($P = 0.00$).

For AIDP subtype of GBS patients, the mean improvement in GBS disability scores from admission to the end of the 8th week was calculated. For IvIg, it is 1.06; for plasma exchange, it is 0.67; and for methylprednisolone, it is 0.13. The values are statistically not significant.

Similarly, for AIDP patients, the mean improvement in MRC disability scores from admission to the end of the 8th week was calculated. For IvIg, it is 2.39; for plasma exchange, it is 1.33; and for methylprednisolone, it is 0.53. The values are statistically significant ($P = 0.0$).

CONCLUSION

A significant proportion of patients presents with peak disability within 8 days of onset of illness to whom definite treatment options are to be made available to enhance a good and early recovery because this is the group associated with poor outcome. The mean improvement in GBS disability scale from admission to the end of the 8th week is more for IvIg-treated patients when compared to methyl prednisolone-treated group, which is statistically significant. It is also applied well to the AIDP subtype of GBS. Although statistically not significant in this study, injection methylprednisolone is associated with a high percentage of the poor outcome when compared to IvIg

and plasma exchange. The prolonged morbidity of the illness evidenced by the need for tracheostomy is more for those treated with methylprednisolone when compared to other definite treatment options.

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Swellings on Forehead – An Enigma: A Case Report

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Abstract

Acute viral labyrinthitis occurs seasonally in one in 600 patients and may last for up to 2 weeks or more. There is no demonstrable cause and etiology for the disease and it remains speculative. The most common virus associated with labyrinthitis is influenza, whereas some cases may even be associated with unidentifiable viruses. This is a rare case report where an 11-year-old girl with viral labyrinthitis mysteriously presented with tender swellings on the forehead which puzzled the pediatrician and the ENT consult in arriving at a diagnosis. This child presented only with mild-to-moderate grade fever and headache initially. None of her presenting illness was contributory toward labyrinthitis. Her blood count was normal and there were no inflammatory markers present. After culture sensitivity testing and a 10-day initial therapy with norfloxacin, her symptoms improved. However, 2 weeks later, she again presented with severe dizziness and fainting episodes and mild ear pain which favored diagnosis toward viral labyrinthitis. The swellings and fever disappeared after prompt treatment. Here, the forehead swellings were very much misleading and kept the pediatrician and the ENT surgeon in confusion. This case report could be an eye-opener in this area.

Key words: Ear, Labyrinthitis, Swelling

INTRODUCTION

Labyrinthitis is an inflammation of the inner ear that affects the balance and hearing of a person. It may occur as a direct infection of the inner ear or a middle ear infection from cold or flu that spreads into the inner ear.^[1] Labyrinthitis is often interchanged with the term vestibular neuritis, but vestibular neuritis is confined to the involvement of vestibular nerve only, whereas the term labyrinthitis indicates the involvement of both the vestibular nerve and the labyrinth.^[2] Both these conditions produce disturbances in balance and coordination in varying degrees and may affect one or both ears. Vestibular neuritis causes vertigo more often than labyrinthitis. The sudden disruption in the afferent neural input results in vertigo, and in the case of labyrinthitis, hearing loss.^[3] The exact cause and etiology of labyrinthitis is still unknown, and researchers and doctors are still probing into that area. Viral labyrinthitis or vestibular neuronitis typically causes symptoms such as vertigo, nausea, and vomiting which are acute in the first

24 h and subside gradually over the next few days and complete cure takes about a month.^[4]

The incidence of labyrinthitis and diseases causing vestibular dysfunction increases with age, and the 1-year prevalence rate is around 35.4%.^[5] The incidence is about 3.5 cases per 100,000 population and it affects both children and adults. The peak age of onset is 40–50 years.^[6] Viral labyrinthitis is common in adults aged 30–40 years and is rare in children. It usually occurs in the 4th decade, and women outnumber men by about 2:1 ratio.^[7] Bacterial labyrinthitis is rare in the antibiotic era. Meningogenic suppurative labyrinthitis is common in children under 2 years and they are at risk of meningitis. Otogenic suppurative labyrinthitis is associated with cholesteatoma.^[8] The labyrinth is a delicate membranous network that incorporates the utricle, saccule, semicircular canals, and the cochlea and consists of peripheral sensory organs for balance and hearing. There is a damage to the vestibular and auditory end organs when the membranous labyrinth gets inflamed. A certain degree of hearing loss is always present in labyrinthine infection as the cochlea is invariably affected.^[9]

Most of the cases of viral labyrinthitis are preceded by an upper respiratory tract infection. Pre-existing bacterial labyrinthitis can also progress into a viral counterpart. A latent herpes infection (HSV-type I) in the vestibular ganglion may get activated affecting the vestibular

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nerve.^[10] In children, an acute localized ischemia of these structures may be one of the causes. Pressure changes experienced in scuba diving and flying may also lead to labyrinthitis. Systemic complications mimicking a common flu or cold (influenza virus) is very common. However, in this case, the child presented unusually with multiple forehead swellings which were tender to touch. There is no evidence of such presentation of a viral labyrinthitis in the literature so far. Swellings on the forehead are unusual in older children, especially when they present without any pre-existing condition or illness. The swellings in this region generally arise from the skin (cellulitis), underlying bone (osteomyelitis), skin structures (carbuncle or infected sebaceous cyst), or sinuses. Tuberculosis of the skin can also present as any kind of unusual swelling.

The forehead swellings caused a deviation in the apt diagnosis, and only symptomatic antibiotic therapy was provided initially. Two weeks later, the child repeatedly presented with fainting and vertigo episodes which were the only symptoms that favored viral labyrinthitis. The team of doctors were able to arrive at a proper diagnosis only by exclusion criteria. Upon treatment her symptoms improved and the swellings on the forehead reduced. This case report can serve as an eye opener among the pediatricians and ENT consultants to be cautious and expect the unexpected so as to provide prompt treatment at the appropriate time to avoid complications and ensure a proper cure for the disease.

CASE REPORT

An 11-year-old girl presented to our outpatient department with moderate-to-high grade fever, malaise, and headache of 10 days' duration. The child was completely normal till this episode. The headache was very severe and was present more in the frontal region. Three swellings of size 1.5 cm × 2 cm were present over the forehead in the region of headache. The child did not have any vomiting or bright visual hallucinations, loose stools, and stiffness of the neck. There was no history of seizures, restriction of neck movements, or limitation of activity. She was admitted to the hospital for 2 days as headache was severe. All blood investigations were normal and there was no increase in the inflammatory markers. She was referred to our clinic by the family physician for further evaluation and management.

Birth history revealed that she is the first child normally at full term. Her birth weight was 3.0 kg, and there was no problem in the neonatal period. She showed normal physical and mental development appropriate for the age and had features of early adolescence but had not yet attained menarche. She had no past history of prolonged

fevers, weight loss, loss of appetite, night sweats, or chronic cough and is immunized up to date. General examination revealed a fairly well-nourished child with a weight of 35 kg (50th centile) and a height of 145 cm (50th centile). Minimal pallor was noted, and the child seemed to be in pain and had a dull look. No clubbing, cyanosis, or enlarged lymph nodes were present. There was no restriction of neck movements or stiffness except for the three swellings in the frontal region in the middle of the forehead each measuring about 1.5 cm × 2 cm in size. The swellings were soft to firm in consistency and tender to touch. The skin over the three swellings was normal and no pulsations were present. There were no other swellings present in any other body part. General examination of all other organ systems was non-contributory.

Repeat blood investigations showed a normal blood count with no increase in any of the inflammatory markers. Magnetic resonance imaging (MRI) of the brain and swellings was normal. Ultrasound (USG) of the swellings showed only edema and did not reveal any other tissue inside. She was also evaluated by a pediatric rheumatologist who ordered all the markers of rheumatological disease such as ANA, anti-ds DNA antibody, and complement to be done and all these were found normal. ENT examination revealed minimal hearing loss on one side. No other abnormalities were noted. Urine cultures showed the presence of 1 lakh growth of *Escherichia coli* colonies sensitive to norfloxacin. She was then started on a 10-day course of the same. Simultaneously, a 5-day course of azithromycin was also given to treat the skin swellings.

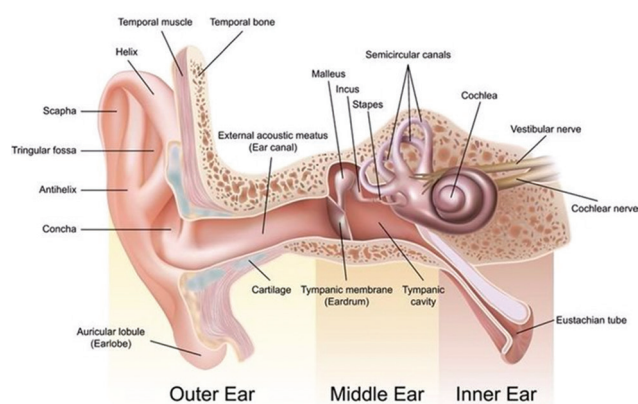
After a 10-day review, she was feeling better with decrease in headache and swelling size and a decrease in tenderness over the swelling. She was well for 2 weeks following which she again developed a moderate grade fever with cold, cough, running nose, and constant headache. She also presented with a slight pain in her ears this time. She had a fainting episode and was readmitted to the hospital where she had another attack of dizziness with nystagmus. Another ENT consult opined that it was a viral labyrinthitis and she was started on tablet cinnarizine and discharged in a day. The headache was present over the frontal swellings intermittently. The dizziness and vertigo episodes gradually decreased, as did the fever. The frontal swellings completely disappeared after nearly 2 weeks.

DISCUSSION

Labyrinth is a membranous structure of the inner ear that is surrounded by dense bone. It gets infected when there is otitis media of the middle ear which can spread further into the inner ear and the internal auditory canal.

Bacterial and viral labyrinthitis do exist with viral being the most common.^[11] The membranous labyrinth consists of the cochlea, which converts sound vibrations into nerve impulses and aids in hearing and the vestibular system that contains a complex network of semicircular canals which maintains balance by providing information about the body's spatial orientation.^[12] The cochlea and the vestibular system send signals to the brain through the vestibulocochlear nerve (8th cranial nerve).^[13] The bony labyrinth is the bony part that contains the membranous labyrinth, which, in turn, is contained in the temporal bone. Labyrinthitis is an infection that affects these structures of the ear and disrupts the flow of sensory information from the ear to the brain that can result in headache, dizziness, vertigo, tinnitus, and even hearing loss.^[14,15]

Anatomy of the Ear



Viral and bacterial infections do exist, and viral labyrinthitis is the most common. In general, bacterial labyrinthitis is more severe than viral labyrinthitis, and the treatment modalities for the two are very different. This is why getting a correct diagnosis from a doctor is important. 25% of the cases have at least a single brief prodrome of vertigo, dizziness, tinnitus, unilateral or bilateral hearing loss, and a feeling of fullness in the ears more typical of Ménière's disease.^[16] Although labyrinthitis is not life-threatening, it is essential to distinguish it from other serious disorders such as transient ischemic attack, stroke, or a brain tumor. An alternative diagnosis should be sought as the presence of otorrhea may also suggest head injury, otalgia suggests herpes zoster oticus, and neck pain or stiffness suggests meningitis or vertebral artery dissection.^[17] Certain drugs such as aminoglycosides, antihypertensives such as amlodipine, antidepressants, antiepileptics, and benzodiazepines can also cause vertigo. All these should be ruled out to arrive at a clear diagnosis.^[18] Carbon monoxide exposure is also a rare cause of acute vertigo and should be ruled out.

The etiology for the three frontal swellings on the forehead associated with this case is not exactly known, but it could be probably because of congestion in the frontal sinuses which also caused intermittent headache in the child. The differential diagnoses for forehead swellings in children, in general, are sinusitis, cellulitis, osteomyelitis, carbuncle, infected sebaceous cyst, hematoma, inflammatory cutaneous tuberculosis, and, rarely, Pott's puffy tumor.^[19] In this case, the swellings on the forehead misdirected diagnosis toward panniculitis as the swellings were soft to firm in consistency and resembled to arise from the subcutaneous fatty tissues. The swellings were thoroughly examined with MRI and USG, and no tissue growth was found inside except for edema. All the blood markers were normal. The headache, dizziness, and vertigo episodes finally lead to the proper diagnosis of viral labyrinthitis.

Viral labyrinthitis is usually characterized by sudden, unilateral loss of vestibular function and hearing. The acute onset of incapacitating vertigo is frequently associated with nausea and vomiting, which is very characteristic of this disorder. In this case, the child initially had only fever and headache which is common to many other diseases and additionally three swellings on the forehead, which again redirected the diagnosis. Most often, patients with viral labyrinthitis are bedridden while the symptoms subside gradually. Vertigo resolves after several days to weeks, whereas unsteadiness and positional vertigo may be present for several months. Hearing loss is the primary presenting symptom in many patients. An URI precedes the onset of cochleovestibular symptoms in about 50% of the cases. Recurrent attacks have been reported but are rare and confused with Ménière disease. The resolution of vertigo and dysequilibrium is due to partial recovery of vestibular function, with concurrent central compensation of the remaining unilateral vestibular deficit. Return of hearing generally mirrors the return of vestibular function. A unique form of viral labyrinthitis is the aforementioned herpes zoster oticus or Ramsay Hunt syndrome which is due to the reactivation of a latent varicella-zoster virus infection that occurs years after the primary infection. This virus may attack the spiral and vestibular ganglion in addition to the cochlear and vestibular nerves.^[20]

If labyrinthitis is suspected, both aural and ocular examinations must be done. The doctor should examine the external ear and the tympanic membrane and look for the presence of cholesteatoma or vesicles in the case of herpes zoster oticus. Mastoid tenderness and nuchal rigidity should be checked for followed by a cranial examination for evidence of palsies and hearing loss. Gait assessment is also to be performed as the patients tend to fall toward the affected side while standing or walking. An inability to walk or stand suggests ischemia. A simple hearing test

with 256-Hz (middle C) or 512-Hz (top C) tuning fork can be done. Head impulse test is a very sensitive test for peripheral vestibular function. Ocular examination should include inspection of the ocular range of motion, papillary response, a funduscopic examination to assess papilledema, and nystagmus. A skew deviation test may also be performed to assess vertigo. The best oculomotor exam (H.I.N.T.S.: Head-Impulse—Nystagmus—Test-of-Skew) appears more sensitive to assess patients with acute labyrinthitis from stroke.^[21]

Conditions to consider in the differential diagnosis of labyrinthitis include vertebrobasilar insufficiency, presyncopal dizziness, cerebellar infarct, dysequilibrium of aging, drug-induced vertigo and/or hearing loss, autoimmune disease of the inner ear, Benign paroxysmal positional vertigo (BPPV), ototoxicity, perilymphatic fistula, skull base tumor, and other cerebellopontine angle tumors.^[22] Routine blood tests and viral antibody tests are not helpful in the diagnosis of viral labyrinthitis. Fungus blood culture in addition to standard blood culture is required. Culture sensitivity test is to be done if middle ear effusions are present. Computed tomography scan is not necessary, but it may help to rule out mastoiditis. Pure-tone audiometry may be indicated in hearing loss. Caloric testing and electronystagmogram help in determining the prognosis for recovery.^[23]

The initial treatment for viral labyrinthitis is bed rest and hydration. Most patients can be treated on an outpatient basis. However, they should be cautioned to seek further medical care if the symptoms worsen, especially neurologic symptoms (e.g., diplopia, slurred speech, gait disturbances, localized weakness, or numbness). Patients with severe nausea, vomiting, and intractable vertigo require hospital admission and may benefit from intravenous fluid and antiemetic medications. Diazepam or other benzodiazepines are helpful as vestibular suppressants. A short course of oral corticosteroids is very helpful. The role of antiviral therapy is not well established. In a randomized controlled trial by Strupp *et al.*, steroids (methylprednisolone) were found to be more effective than antiviral agents (valacyclovir) for recovery of peripheral vestibular function in patients with vestibular neuritis and these apply to the treatment of viral labyrinthitis as well.^[24] The antiviral drugs such as acyclovir, famciclovir, and valacyclovir shorten the duration of viral shedding in patients with herpes zoster oticus and prevent some auditory and vestibular damage if started early in the clinical course. Corticosteroids are administered to reduce inflammation and edema in the facial canal and labyrinth. Here, the child was treated with cinnarizine (antihistamine and calcium channel blocker) to reduce the symptoms of cold. She was also treated initially with norfloxacin due to the presence of *E. coli* in urine cultures (indicates a

coexisting bacterial infection) and azithromycin to treat the skin swellings.

CONCLUSION

The fever and headache episodes gradually progressed to dizziness and fainting in this child due to missed diagnosis at an early stage. This, of course, is a rare presentation of viral labyrinthitis with the forehead swellings that stole all the attention. The diagnosis was made only by exclusion criteria, and there was no definitive symptom initially suggestive of labyrinthitis. Viral labyrinthitis is usually benign and self-limiting. The complications usually are unilateral hearing loss, BPPV, and falls. Prognosis of hearing loss with viral labyrinthitis is usually better once the acute infection is resolved. Bacterial or suppurative labyrinthitis may result in profound hearing loss. The vertigo and dizziness may still be present for a few days to weeks even after resolution of the primary infection. In this case, the child gradually recovered in 2 weeks' time once prompt treatment was initiated and the frontal swellings also disappeared completely. This case report teaches the pediatrician and the ENT consult always to expect the unexpected and be ready for any kind of presentation of a usual disease in an unusual manner to ensure prompt and early diagnosis and avoid complications. In our case, the forehead swellings indeed were an enigma!!!

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Juvenile-onset Huntington's Disease: A Rare Case Report

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Abstract

Juvenile-onset Huntington's disease (JHD) is a rare autosomal dominant neurodegenerative disorder of the central nervous system characterized by the presence of abnormal involuntary movements, rigidity, and ataxic gait. We are presenting a rare case of a 9-year-old male who was referred to the Radiology Department of Gandhi Medical College and Hamidia Hospital for magnetic resonance imaging (MRI) brain with complaints of progressive impairment of gait, bradykinesia, and marked postural instability for the past 2 years. The patient also had a history of episodes of seizures for 4 years. MRI findings revealed: Atrophy of bilateral caudate nuclei and putamina of basal ganglia.

Key words: Atrophy caudate nucleus, Juvenile-onset Huntington's disease, Putamina

INTRODUCTION

Juvenile-onset Huntington's disease (JHD) is a rare autosomal dominant neurodegenerative disorder of the central nervous system characterized by the presence of abnormal involuntary movements, rigidity, and ataxic gait.

In 1872, George Huntington (1850–1916), a medical practitioner of Pomeroy, Ohio, USA, made the first complete description of this disorder among the population of Long Island in New York State.^[1]

The molecular origin of the disease is the cytosine adenine guanine trinucleotide increase in the Huntington gene which is located in 4p16.3 chromosome.^[2]

We are presenting a case of a 9-year-old male who was referred to the Radiology Department of Gandhi Medical College and Hamidia Hospital for magnetic resonance

imaging (MRI) brain with complaints of progressive impairment of gait, bradykinesia, and marked postural instability for the past 2 years. The patient also had a history of episodes of seizures for 4 years.

MRI findings revealed:

- Marked atrophy of bilateral caudate head resulting in enlargement of bilateral frontal horns [Figure 1].^[3]

It can be quantified by three measurements that were obtained on axial images at the level of the third ventricle: (a) The FH width, representing the distance between the most lateral aspects of the frontal horns; (b) the intercaudate distance (CC), the distance between the most medial aspect of the caudate nuclei; and (c) the IT width, the distance between the inner tables of the calvarium at the level of the CC measurement [Figure 2].

- Frontal horn width to intercaudate distance ratio (FH/CC), which in our case is -0.85 (normal range is $2.2-2.6$)
- Intercaudate distance to inner table width ratio (CC/IT), which in our case is 0.26 (normal range is $0.09-0.12$); (as the caudate heads are reduced in size, the CC distance will increase and so will the CC/IT ratio).

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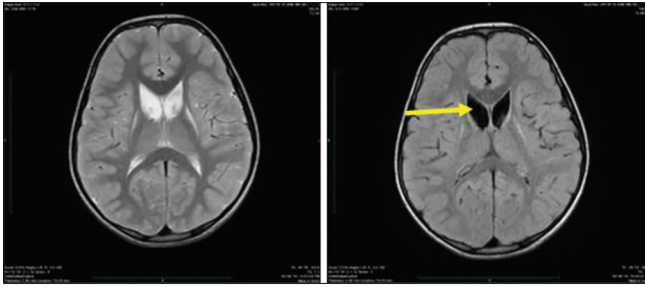


Figure 1: Axial T2 and FLAIR images show bilateral caudate head atrophy [arrow] resulting in enlargement of frontal horns. Frontal horn width to intercaudate distance ratio (FH/CC) is -0.85 [normal range is $2.2-2.6$]. Intercaudate distance to inner table width ratio (CC/IT) is 0.26 [normal range is $0.09-0.12$], (as the caudate heads are reduced in size, the CC distance will increase and so will the CC/IT ratio)

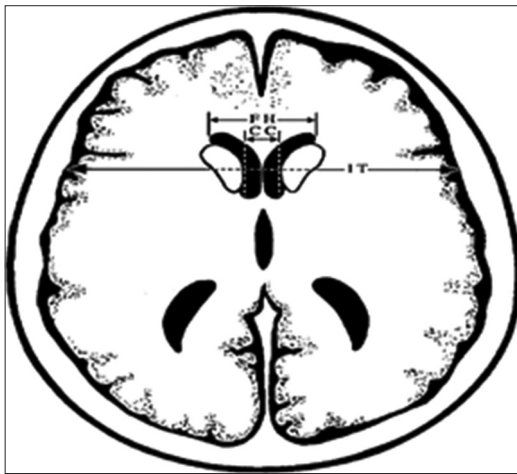


Figure 2: Schematic diagram of an axial view at the level of the third ventricle shows heads of the caudate nuclei at which the intercaudate distance (CC), the frontal horn width, and calvarial inner table width can be measured

- Atrophy of putamina of bilateral basal ganglia with T2/FLAIR hyperintense signals within [Figure 3].
- Rest of the cerebral, cerebellar brain parenchyma, and brainstem was normal [Figure 4], thus ruling out its differentials which are hypomyelination with atrophy of basal ganglia and cerebellum (H-ABC), Leigh and Wilson disease.

Points to Ponder

1. Huntington disease usually occurs in adults (third or fourth decades) and is rare in children; then, it is

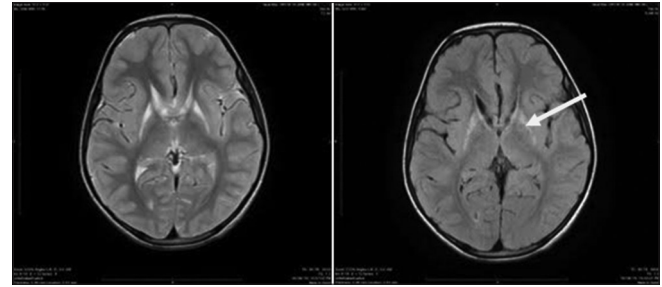


Figure 3: Axial T2 and FLAIR images show bilateral symmetrical hyperintensities in atrophied bilateral putamina [arrow]



Figure 4: Axial T2 image shows normal cerebellar hemispheres, thus ruling out hypomyelination with atrophy of basal ganglia and cerebellum (H-ABC)

classified as JHD. Its prevalence in world ranges from 5 to 10/100,000.^[4]

2. JHD has a more rapidly progressive course, with death occurring in 7–8 years of disease onset.^[4]

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Management of a Case of Subungual Glomus Tumor by Periungual Surgical Excision: A Case Report

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Abstract

Glomus tumors of the subungual region are a group of benign hamartomas due to proliferation of glomus cells. The lesion presents as a brownish purple lesion in the nail bed. Classical triad suggestive of the disease consists of severe pain, local tenderness, and sensitivity to cold. Diagnostic tests include Love's pin test, Hildreth's test, and transillumination test. Complete surgical excision by either the transungual or periungual approach usually provides symptomatic relief with little chance of recurrence. Periungual approach is associated with less complications.

Key words: Glomus Tumour, Subungual region, Periungual approach

INTRODUCTION

Glomus tumor of the subungual region is a rare vascular neoplasm, which usually presents with severe pain and occasionally with nail deformity. This case report is of a 35-year-old female with subungual glomus tumor of her right little finger which was managed by surgical excision of the tumor by the periungual approach.

CASE REPORT

A 35-year-old female presented with a history of pain in tip of right little finger for the past 7 years. Pain increased on contact with cold water. On examination, there was a brownish blue discolored area on the nail bed [Figure 1]. Love's pin test was positive [Figure 2]. Preoperative radiograph and magnetic resonance imaging (MRI) were done. Radiograph showed scalloping of the distal phalanx of the right fifth finger [Figure 3]. MRI showed a high-signal intensity lesion on T2-weighted images [Figure 4].

Treatment – Surgery through periungual approach tumor excision was done [Figure 5].

Histopathological report was suggestive of glomus tumor [Figure 6].

Three months post surgery the patient had remarkable decrease in symptoms without any complications [Figure 7].

DISCUSSION

Glomus tumor of the subungual region is an uncommon benign neoplasm of vascular origin. It occurs due to the proliferation of glomus cells in the glomus body, which is present in abundance under the nail bed. Glomus body is a specialized neuromyoarterial structure which acts as an arteriovenous anastomosis responsible for cutaneous circulation and temperature regulation. Nonmyelinated nerve fibers present adjacent to the perivascular glomus cells are responsible for the excruciating pain and cold sensitivity seen in patients with glomus tumor.^[1]

This uncommon hamartoma usually presents with severe pain and occasionally with nail deformity, more commonly in women (four times more than in men) in the age group of 30–50 years. The etiology is not clearly known. A variety of mutations are known to occur, with the glomulin gene in chromosome 1 commonly involved.^[2] There is an autosomal dominant pattern of inheritance. When multiple digits are involved, it is usually associated with neurofibromatosis Type 1.

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Figure 1: Brownish blue discolored area on the nail bed



Figure 4: Magnetic resonance imaging showing a high-signal intensity lesion on T2-weighted images



Figure 2: Love's pin test



Figure 5: Tumor excision was done through periungual approach



Figure 3: Radiograph showing scalloping of the distal phalanx of the right fifth finger

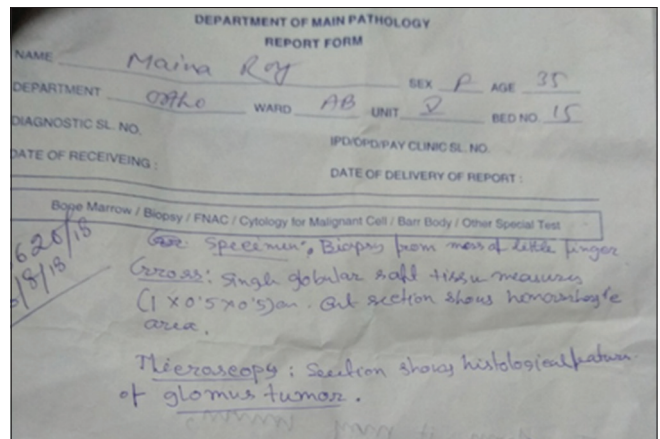


Figure 6: Microscopic examination report shows histological features of glomus tumor

A meticulous history and careful physical examination are needed for diagnosing this condition. Glomus tumor usually presents as a solitary lesion <1 cm in size. It has a brownish purple discoloration on the nail bed. In 50% of the cases,

an associated nail deformity may be present. There is a characteristic classical triad which is highly suggestive of



Figure 7: Three months post-surgery patient had remarkable decrease in symptoms with no complications

the diagnosis – severe pain, local tenderness, and sensitivity to cold.^[3] Common tests performed are the Love's pin test, Hildreth's test, and transillumination test. In Love's pin test, pressure is applied to the suspected area with a pinhead, and elicitation of severe pain is a positive result. In Hildreth's test, a tourniquet is applied to the arm on the affected side, and a positive test is suggested by the following – on removal of the tourniquet, there is a sudden return of severe pain in the affected nail bed (as transient ischemia in the limb reduces the pain in the affected nail bed, checked by Love's pin test). A cold sensitivity test can also be performed where application of ice to the suspected nail bed results in increased pain at the nail bed. According to Netscher *et al.*, Love's pin test had 100% sensitivity and 78% specificity, while Hildreth's test had 100% specificity and 71% sensitivity.^[4]

Diagnostic imaging studies include radiographs, MRI, and ultrasound. Radiograph of the affected digit shows scalloping of the phalanx. A MRI is useful to know the size and extent of tumor so as to avoid any excessive excision of the nail bed. A MRI can detect lesions 2 mm or more in size. The lesion is seen as low-signal intensity on T1-weighted images, with enhancement on gadolinium injection and as high-signal intensity on T2-weighted images.

Differential diagnoses of subungual glomus tumor include paronychia, neuroma, Raynaud phenomenon, gouty arthritis, and subungual exostosis.

Treatment of subungual glomus tumor is by surgical excision. Surgery is done under tourniquet application, and regional anesthesia is preferred. There is remarkable symptomatic relief and decreased chances of recurrence with complete

excision of the tumor. Two approaches are used – transungual and periungual. Post-operative complications such as nail deformity are more common with the transungual approach.^[5] Persistence of symptoms after surgical excision is usually due to inadequate excision rather than new tumor growth.

Prognosis of subungual tumors is excellent. Adequate surgical excision of tumor usually results in complete symptomatic relief.^[6]

CONCLUSION

Subungual glomus tumors are uncommon benign hamartomas usually presenting with severe pain and occasional nail deformity. The pain is aggravated by cold and touch. As such, excision of the tumor is expected to provide symptomatic relief. Tumor excision through periungual approach is an effective modality of treatment as it completely removes the lesion and thereby decreasing the chances of recurrence. This approach also has less complication rate and provides complete symptomatic relief.

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