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Screening of Serum Uric Acid in Obese Individuals in Rural Population

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Abstract

Introduction: Uric acid is a metabolic product of exogenous (brought in with food) or endogenous purine bases. Since uric acid is found in human serum in relatively low concentrations (reference range is 0.21 to 0.42 mmol/L in men and 0.16 to 0.36 mmol/L in women) it is necessary to use specific and sensitive methods for its determination in visceral individuals including obese persons.

Purpose: The purpose of this study is to estimate serum uric acid level in among obese individuals attending a medical college hospital.

Methods: An observational study was designed to study 240 subjects, aged 20 to 50 years. The study included 120 apparently healthy obese individuals with Body Mass Index of ≥ 25 and Waist Circumference more than 80 cm and 90 cm in females and males respectively. Another 120 individuals with body mass index ≤ 25 , waist circumference less than 80 cm and 90 cm in females and males respectively enrolled as controls. Uric acid was measured in serum. Data were analyzed statistically using statistical package for the social sciences version 17.

Results: The mean value of serum uric acid in obese men and women were 7.57 mg/dl and 6.19 mg/dl which was higher than the mean of control group 4.17 mg/dl (males) and 4.10 mg/dl (females).

Conclusion: Serum uric acid was elevated in obese individuals indicating the marker for metabolic syndrome. However further studies are suggested with large number of samples to confirm or refute the present observation.

Keywords: BMI, Hyperuricemia, Metabolic syndrome, Obesity, Waist circumference

INTRODUCTION

Uric acid is the end product of Purine metabolism in humans. Hyperuricemia can result from either increased uric acid synthesis or decreased uric acid excretion, or from a combination of both. Association between serum uric acid levels and metabolic syndrome (MetS) had been reported in previous cross-sectional studies.¹ Obesity is a principal causative factor in the development of metabolic syndrome.

Earlier studies have brought out the prevalence of hyperuricemia from urban population. Uric acid is an organic compound that is endogenously produced as a purine metabolite. Mainly the uric acid is secreted in liver and excreted via kidneys and intestines. Basically the

uric acid is a weak acid that have a high dissociation and circulates in plasma in the form of monovalent sodium salt.

Uric acid exit from the pool is mainly controlled by the kidneys. In the kidney, uric acid and urate are initially filtered and additionally secreted. WHO (World Health Organization) highlighted that more than 1.4 billion adults were overweight.²⁻⁴ The synthesis of fatty acids in the liver is associated with the de novo synthesis of purine, thus accelerating UA production. Uric acid serum concentrations are independently related to leptin concentration^{5,6} thus suggesting that would be a pathogenic factor responsible for UA increase in obese patients.

However serum UA has not been reported as an independent cardiovascular risk factor, but only an

additional factor associated with cardiovascular disease, like dyslipidemia, hypertension and insulin resistance. Hence the present study was proposed to bring out the status of hyperuricemia in rural population.

MATERIALS AND METHODS

This was the prospective observational study conducted in the tertiary care hospital. We enrolled 285 patients who attended tertiary hospital, Trichy for Master Health Checkup and 240 were included in the final study. These individuals were classified into two groups according to the BMI and WC. The study subjects included were 120 apparently healthy obese individuals (study group) aged between 20 and 50 years with Body Mass Index of ≥ 25 (revised cut-offs for Asians) and Waist Circumference more than 80 cm and 90 cm in females and males (Misra *et al.*, 2009) respectively. Another 120 individuals with BMI ≤ 25 were enrolled as controls (age and sex matched). Controls were also selected based on WC less than 80 cm and 90 cm in females and males respectively.

A detailed history was elicited for any Co-morbid diseases and concomitant drug intake. All participants signed an informed, written consent to participate in the clinical examinations and biochemical investigations before entering the study. Pre designed questionnaire was used to assess conventional risk factors, demographic profile (age, sex, and rural residence, dietary history), and drug history. Systemic and anthropometric examination was done for all individuals. Weight was measured using SECA Integra 815 portable scale with accuracy of 0.01 kg.

Height was measured by using portable stadiometer with an accuracy of 0.1 cm. Waist circumference was measured at a level midway between the lowest rib and the iliac crest by an inch tape. Body mass index was calculated using the formula, Weight in kg/height in m². Blood samples were drawn from the subjects under strict aseptic precautions and allow them to clot and centrifuged at 2000 rpm for 15 minutes for biochemical analysis. The serum was separated and samples were processed within 1 hour from the time of collection. Serum uric acid was measured by uricase–peroxidase method (DiaSys Diagnostic systems GmbH & Co.KG, Piramal health care) where uric acid is oxidized to allantoin by uricase.

The generated hydrogen peroxide reacts with 4 aminoantipyrine and 2, 4, 6 tribromo-3-hydroxy benzoic acid to form quinoneimine. The color produced was measured at 546 nm. Some studies defined the range of hyperuricemia as >7.0 mg/dl in men or >6.0 mg/dl in women (Xuemei *et al.*, 2008). These may be commonly used in clinical laboratories

and have been proposed in previously-published studies in relation to CVD outcomes to define hyperuricemia. The statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 17.

RESULTS

Age and Sex matched subjects were divided into 2 groups (study and control) based on BMI and WC as mentioned in materials above. Each group consists of 120 subjects, among whom male subjects were 56 (obese males) and female subjects were 64 (obese females) as shown in Table 1.

The mean age group, BMI and WC of obese male and obese female was 35.46 ± 7.86 and 36.09 ± 7.28 ; 29.05 ± 1.64 and 28.84 ± 2.07 ; 99.07 ± 4.57 and 88.82 ± 4.20 respectively as shown in Table 1. The mean value of serum uric acid in obese men was 7.57 mg/dl which was higher than the mean value of control group (4.17 mg/dl) with 'p' value of 0.001. Similarly, the mean of serum uric acid in female study group (6.19 mg/dl) was significantly more than the control group with mean of 4.17 mg/dl. This difference in the serum uric acid level between control and study group gives a significant 'p' value of <0.0001 as shown in Table 2. Out of the sixty four female obese individuals, ten subjects had uric acid levels more than the normal range (>7 mg/dl) and thirty nine individuals were within the range of 6.0-6.9 mg/dl as shown in Table 3.

Table 1: Demographic characters of the subjects included

Demographic characters	All	Cases	Controls	p
Total number	240	120	120	0.10
Male sex	112	56	56	0.10
Female sex	128	64	64	0.10
Male (age in years)	34.90 ± 7.76	35.46 ± 7.86	34.33 ± 7.62	0.47
Female (age in years)	34.72 ± 6.89	36.09 ± 7.28	33.35 ± 6.19	0.16
Body mass index in males	25.93 ± 3.36	29.05 ± 1.64	22.81 ± 0.73	0.000
Body mass index in females	25.53 ± 3.67	28.84 ± 2.07	22.22 ± 0.91	0.000
Waist circumference in males	87.40 ± 12.71	99.07 ± 4.57	75.73 ± 5.28	0.000
Waist circumference in females	80.64 ± 9.12	88.82 ± 4.20	72.46 ± 3.75	0.000

Table 2: Serum uric acid level between control and study group

Parameters	All	Cases	Controls	p value
Serum uric acid in males (mg/dl)	5.87 ± 1.79	7.57 ± 0.65	4.17 ± 0.53	0.001
Serum uric acid in females (mg/dl)	5.12 ± 1.4	6.19 ± 1.10	4.10 ± 0.56	0.001

Table 3: Serum uric acid levels among males and females included

Males	Uric acid	Females	Uric acid	p value
14	>7 mg/dl	10	>8 mg/dl	0.001
38	6-6.9 mg/dl	39	7-7.9 mg/dl	0.001
4	Upto 5.9 mg/dl	15	Up to 6.9 mg/dl	0.001

DISCUSSION

Elevated uric acid is a known risk factor for vascular diseases and it adds as a marker of oxidative stress. We report four main findings from the present study.

1. The mean of serum uric acid in male obese group was 7.57 mg/dl which was significantly more than the control group 4.17 mg/dl ($p < 0.001$).
2. The mean of serum uric acid in female obese group was 6.19 mg/dl which was significantly more than the control group 4.10 mg/dl ($p < 0.001$).
3. Serum uric acid level was positively correlated in both males and females of study group with significant Pearson's r value of $= 0.66$ and 0.63 respectively.
4. Serum uric acid is correlated significantly with waist circumference ($r=0.52$, $p=0.001$) but poorly correlated with BMI ($r=0.18$).

Some studies highlighted the importance of uric acid as a marker of increased cardiovascular risk. Subsequently, other studies suggested that individuals with high normal uric acid levels are at risk of metabolic syndrome. In agreement with previous studies, we found that the higher serum uric level was positively and significantly associated with healthy obese individuals. These results demonstrate that serum UA level is a strong marker of the risk for developing MetS. Hyperuricemia is observed in individuals with insulin resistance, probably because hyperinsulinemia would cause lower renal UA excretion. High levels of serum UA were associated with endothelial dysfunction, anti proliferative effects, impaired nitric oxide production,⁷ lipid peroxidation and smooth muscle proliferation.^{1,8}

Hyperuricemia leads to impaired endothelium-mediated vasodilation⁸ even in the absence of existing cardiovascular disease. Similarly, endothelial dysfunction may underlie the causes of other aspects of hyperuricemia-related cardiovascular diseases. Research in nutrition of some studies has shown that WC is a stronger marker of health risk than BMI. Higher waist circumference and BMI are associated with higher insulin resistance and it reduces renal uric acid excretion, thus increasing its concentration. We suggest that greater emphasis should be placed on WC in assessing the obese individuals for cardiovascular

risk. One possible explanation for the association between higher waist circumference and hyperuricemia were suggested^{9,10} that serum UA concentration were independently related to leptin concentration, indicated the pathogenic factor responsible for UA increase in obese patients.

This has the potential of improving patient care without increasing the cost to the healthcare system. The interpretation of this investigation suggested that individuals with high normal uric acid levels are at risk of metabolic syndrome including heart diseases and stroke. Life style modifications may be required to meet out these issues. Developing countries like India are facing the increasing incidence of obesity and metabolic disturbances leads to cardiovascular diseases.

The awareness regarding obesity related to high uric acid level and modify the life style including avoid the junk food may considered as better preventive interventions. Hence, interventional strategies are urgently needed among apparently healthy obese individuals with hyperuricemia for prevention of cardiovascular diseases. High uric acid may become surrogate marker of atherosclerosis.

CONCLUSION

Elevated levels may also be found after ingestion of a diet rich in purine, or a marked decrease in total dietary intake, resulting in increased tissue breakdown. In general hyperuricemia are associated the clinical disorders including acute and chronic nephritis, urinary obstruction, gout, diabetic ketoacidosis, high purine diet, leukemia, malignant tumors especially with extensive necrosis, acute infections, alcohol ingestion and certain toxins and some diuretics. The decreased serum uric acid levels are associated with pernicious anemia, acute yellow atrophy of the liver, salicylate and cinchophen therapy. Thus, screening of individuals with hyperuricemia may provide the wonderful marker for the clinician to treat the patients and to avoid the risk of co-morbidity.

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A Comparative Study of Sonourethrography and Retrograde Urethrography in Evaluation of Anterior Male Urethral Strictures

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Abstract

Introduction: The male urethral imaging and pathology is not widespread in the radiology literature because this part of the urinary tract is easily studied by urologists. However urethral obstructive pathologies especially stricture disease is a gray area which needs thorough imaging. Retrograde urethrography has been the standard imaging technique for the evaluation of male anterior urethra, which involves use of radiation and contrast medium. Sonourethrography is a new technique for imaging the male anterior urethra with high-resolution ultrasound while intra-urethral instillation of normal saline.

Aims & Objectives: This study was undertaken to explore the uses of sonourethrography with high-resolution ultrasound in evaluating stricture disease of the male anterior urethra and comparing it with retrograde urethrography.

Materials & Methods: This study was carried out on 60 male patients referred for retrograde urethrography to the department of Radiodiagnosis. These patients underwent retrograde urethrography followed by sonourethrography.

Result: Out of 60 patients, 11 patients were normal, 44 patients had stricture. Rest 5 patients without stricture had Urethrocutaneous fistula, false tract and diverticula. Total 53 strictures were demonstrated in 44 patients, 51 were diagnosed on sonourethrography and 53 on retrograde urethrography. One bulbar and two membranous urethra strictures were missed on sonourethrography and diagnosed on retrograde urethrography. One penile stricture was diagnosed on sonourethrography but missed on retrograde urethrography. Strictures were further characterized as per location, number, length, periurethral fibrosis and other findings.

Conclusion: Compared with retrograde urethrography, sonourethrography is equally efficacious in detecting anterior urethral strictures. The further characterization of strictures in terms of length, periurethral pathologies can be performed with relatively greater sensitivity using the sonourethrography. Thus, ability of sonourethrography to diagnose periurethral pathologies and length of stricture helps in planning proper surgical procedure.

Keywords: Male, Retrograde Urethrography, Stricture, Sonourethrography, Urethra

INTRODUCTION

Urethral pathologies, especially strictures are common problem affecting young adult males and are a major cause of morbidity and discomfort. The male urethral imaging and pathology is not widespread in the radiology literature because this part of the urinary tract is easily studied by urologists with clinical or endoscopic examinations. However, imaging has an important role to play in the study of the stricture diseases of the male urethra since it can detect pathology not visible on urethroscopy.¹

Retrograde urethrography (RGU) is the standard imaging study for the evaluation of anterior male urethra.

Originally, RGU was performed using penile clamps and other devices. McCallum² popularized use of Foley's catheter in the distal urethra to help retain contrast material after filling.

Diagnostic imaging of the male urethra has depended on these techniques, which involve the use of radiation and intra-urethral injection of contrast medium to visualize luminal anatomy. Limitations of RGU in accurate evaluation of anterior urethral stricture diseases include variation in the appearance of strictures with position of the patient and the degree of stretch of the penis during the study. It also provides limited information about periurethral structures.

In 1988 McAninch et al.³ reported a new technique for imaging the male anterior urethra with high-resolution ultrasound (sonourethrography). The initial technique involved the use of a 5 MHz linear array transducer applied to the dorsal surface of the penis. Images were obtained during retrograde instillation of normal saline. As the normal urethral wall and spongiosum are elastic they are compressible on saline injection. When altered by stricture disease the corpus spongiosum loses its elasticity due to higher collagen content and is not compressible, causing a reduction in the inner diameter of the urethra.

An ideal study should be able to indicate the type of surgical procedure suitable for the patient. This includes accurate determination of the site, length and diameter of strictures. Complete preoperative knowledge of complicating conditions like urethral calculi, fistulae, false tracts, diverticula and polyps facilitate favorable urethroplasty outcomes.

As a dynamic, three-dimensional study, which can be repeated without radiation exposure, sonourethrography (SUG) offers important technical advantages compared with RGU. This study was undertaken to explore the uses of high-resolution color Doppler ultrasound in evaluating stricture disease of the male anterior urethra and comparing it with RGU.

MATERIAL AND METHODS

This study was carried out in the Department of Radiology, Indira Gandhi Government Medical College and Mayo Hospital, Nagpur over a period of 3 years from 2002 to 2005.

Sixty male patients referred for retrograde urethrography were selected. Those with symptoms suggestive of acute urethritis were excluded, while patients with recent instrumentation procedure were postponed for a week.

Informed consent regarding the procedures to be performed was taken from all patients. The patients underwent RGU followed by SUG 3-4 days later, on their subsequent visit to collect the RGU report.

Retrograde urethrography was performed with Siemens klinoskop - H 300 mA x-ray machine. Sonourethrography studies were performed with standard ultrasound scanners 1. ESAOTE color Doppler equipment and 2. GE LOGIC 3 PRO color Doppler equipment with a 5, 7.5, 10 MHz transducers.

The male urethra has been conventionally divided as anterior and posterior. The anterior urethra is further

divided into distal long penile part extending from meatus up to penoscrotal junction; and proximal bulbar part up to pelvic diaphragm. The posterior urethra is made up of short fixed membranous part at the pelvic diaphragm and wider prostatic part. The locations of strictures were described as penile, bulbar and membranous as per the involved part.

Term 'Single stricture' implied single location even if there were multiple strictures in that same location. 'Complex stricture' has been used for strictures at multiple locations. Complex and multiple strictures are considered together as per their surgical management as suggested by Chiou R.K. et al.⁴

The stricture length and diameter were determined using electronic caliper measurements. We categorized stricture length as short strictures less than 2.5 cm in length and long strictures, more than 2.5 cm in length. This classification is modification of classification by Chiou R K et al.⁴ and Morey A. et al.⁵ made as per the type of urethral surgery required.

Periurethral fibrosis was identified as regions of greater echogenicity in corpus spongiosum, and was classified as per the classification by Chiou R.K. et al.⁴ as.

- i. Minimal spongiosal tissue involvement demonstrates either no identifiable spongy tissue involvement or a minimal abnormality.
- ii. Moderate spongiosal tissue involvement shows definite areas of abnormal tissue beneath the urethral surface with sonographically normal tissue in the periphery.
- iii. Extensive spongiosal tissue involvement consists of a near full-thickness involvement of the corpus spongiosum.

The sensitivity, specificity, positive and negative predictive value of all parameters was calculated. The strength of agreement between RGU and sonourethrography was calculated using kappa statistics, whereby a kappa value of, 0.2 indicated a poor agreement, 0.21-0.40 indicated a fair agreement; 0.41-0.60, moderate agreement; 0.61-0.80, good agreement; 0.81-1.00, very good agreement.

RESULTS & OBSERVATIONS

Out of 60 patients, the average age was 36.33 year. Maximum number of patients belonged to 2nd and 3rd decade (Table 1, Figure 1). All patients with clinical diagnosis of urethral obstruction were studied with sonourethrography. These findings were compared with retrograde urethrography, which is time proven 'gold standard' (Figure 2). Urethrography ruled out any urethral

obstructive lesion in 11 patients and those were reported to be having normal study (Figure 3). Remaining 49 patients had definite signs of urethral obstruction of varying type.

Out of these 49 patients, 44 patients had stricture and five patients without stricture were as follows, 3 with diverticula including syringocele type-2 (Figure 7), one with false tract (Figure 8) and one with urethrocutaneous fistula (Figure 9).

Total 53 strictures were demonstrated in 44 patients. Total 51 strictures were diagnosed on SUG and 53 on RGU. One bulbar and two membranous urethra strictures were missed on SUG and diagnosed on RGU. One penile stricture was diagnosed on SUG but missed on RGU.

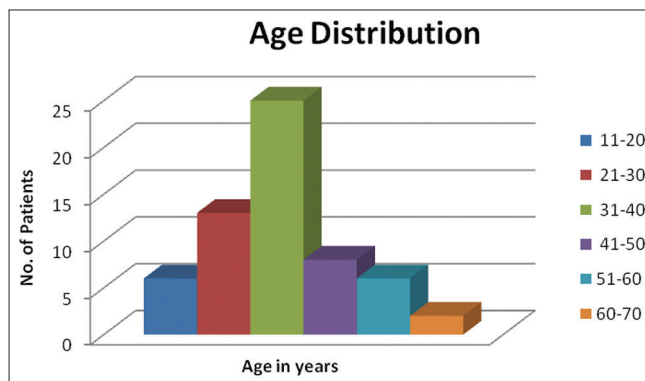


Figure 1: Age distribution of the patients with urethral obstructive complaints

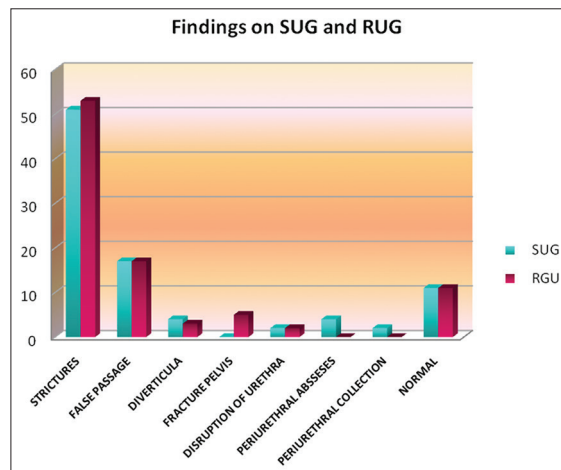


Figure 2: Comparative findings on SUG and RGU

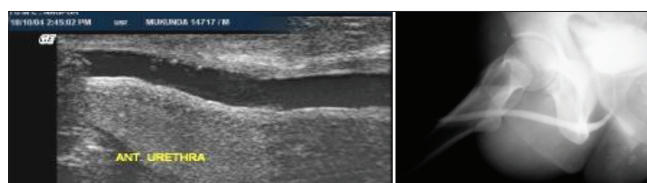


Figure 3: Sonourethrography and retrograde urethrography appearance of normal anterior male urethra

These strictures were further characterized as per location, number, length, periurethral fibrosis and other findings.

Location of Strictures (Table 2)

Bulbar urethral strictures were the commonest found in 26 patients with both the modalities. One extra bulbar stricture was diagnosed on RGU however it was missed on SUG.

Table 1: Distribution of patients according to age

Age (years)	No. of patients	Percentage
11 to 20	06	10.00%
21 to 30	13	21.70%
31 to 40	25	41.70%
41 to 50	08	13.30%
51 to 60	06	10.00%
60 to 70	02	03.30%
Total	60	100%

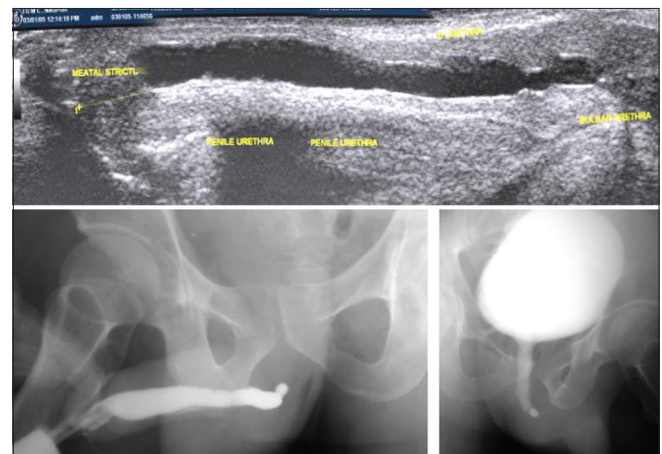


Figure 4: Sonourethrography, retrograde urethrography and voiding cystourethrography appearance of complete short segment stricture bulbar urethra

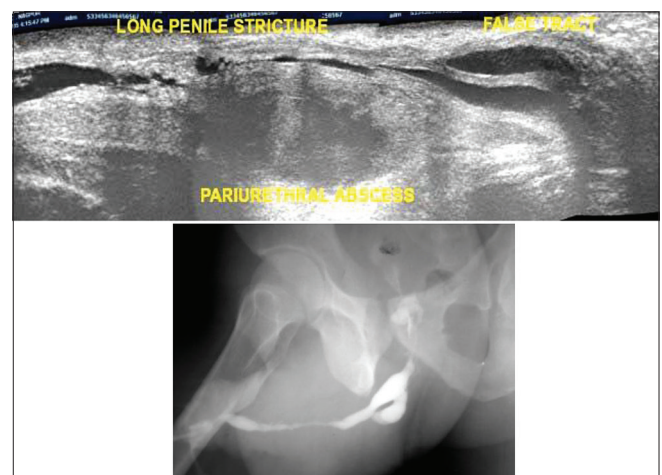


Figure 5: Sonourethrography and retrograde urethrography appearance of long segment stricture penile urethra with periurethral abscess and false tract

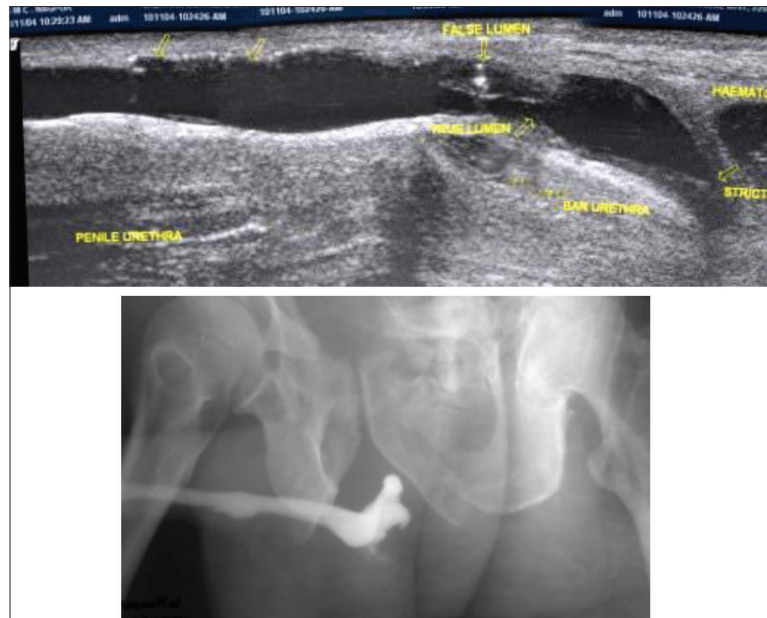


Figure 6: Sonourethrography and retrograde urethrography appearance of post-traumatic disruption of bulbar urethra with periurethral haematoma and false tract

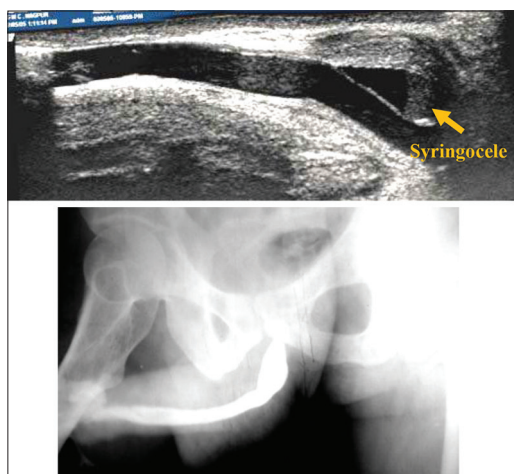


Figure 7: Sonourethrography and retrograde urethrography appearance of unruptured syringocele

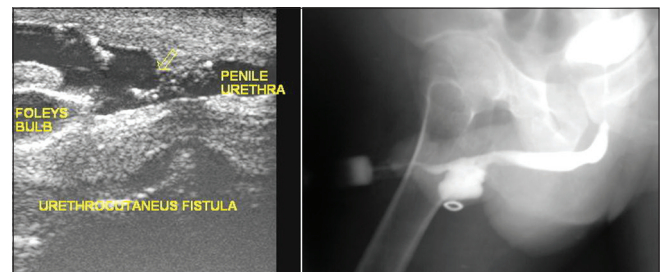


Figure 9: Sonourethrography and retrograde urethrography appearance of urethrocutaneous fistula



Figure 8: Sonourethrography and retrograde urethrography appearance of post-instrumentation false Passage

Total eight penile strictures were diagnosed on both the modalities. One extra penile stricture diagnosed on SUG was not seen on RGU. Two penile strictures categorized as pure penile were actually complex strictures involving penile and membranous urethra as membranous strictures were not visualized on SUG.

Seven complex strictures visualized on both the modalities all were penile and bulbar urethral complex strictures; however two complex strictures involving penile and membranous urethra were visualized only on RGU.

Number of Strictures (Table 3)

Both the modalities diagnosed 30 single strictures. One additional single bulbar and single penile stricture diagnosed by SUG and RGU respectively. 13 complex strictures were diagnosed with equal accuracy on both the modalities.

Length of Strictures (Table 4)

Out of 44 patients, 28 patients had short segment strictures, 3 patients had long segment strictures and 13 patients had complex strictures. Out of the 28 short segment strictures, 22 were bulbar (Figure 4) while six were penile short segment strictures. In long segment strictures total three patients were identified, two were penile (Figure 5) and one was bulbar stricture found on SUG which were categorized in short segment category on RGU.

Table 2: Distribution of patients according to location of strictures

RGU SUG	Penile	Bulbar	Complex	Normal	Total
Penile	8	0	2	1	11
Bulbar	0	26	0	0	26
Complex	0	0	7	0	7
Normal	0	1	0	15	16
Total	8	27	9	16	60

Table 3: Distribution of patients according to number of strictures

RGU SUG	Single	Multiple	Normal	Total
Single	30	0	1	31
Multiple	0	13	0	13
Normal	1	0	15	16
Total	31	13	16	60

Table 4: Distribution of patients according to length of strictures

RGU SUG	Short	Long	Complex	Normal	Total
Short	27	0	0	1	28
Long	1	2	0	0	3
Complex	0	0	13	0	13
Normal	1	0	0	15	16
Total	29	2	13	16	60

Periurethral Fibrosis (Table 5)

Out of 44 patients with diagnosis of urethral stricture diseases, sonourethrography revealed periurethral fibrosis in 34 (56.7%) patients.

Other Periurethral Findings (Table 6)

Other findings such as periurethral hematoma, periurethral abscesses, diverticula and false passages were well seen on sonourethrography. Four patients had periurethral abscesses two of them were opening in the urethra and one opening outside. Two patients with trauma had associated periurethral hematoma and collection. However these periurethral hematoma and periurethral abscesses were missed on RGU.

Total 4 cases of diverticula diagnosed on sonography. Out of these two were wide-mouthed diverticula and one shallow penile urethra diverticulum. Case of Syringoceles type-2 (Figure 7) also considered under the heading of diverticula as it is described under same heading, suppose to be congenital and have tendency to open in the urethral lumen to give appearance as diverticulum.^{6,7} False passages were seen in 16 patients with one patient having urethrocuteaneous fistula (Figures 5 & 6).

Table 5: Grades of periurethral fibrosis in relation to stricture on SUG

Grade of fibrosis	Number of patients	Percentage
Minimal	07	11.70%
Moderate	13	21.70%
Extensive/severe	14	23.30%
No fibrosis	26	43.30%
Total	60	100%

Table 6: Distribution according to periurethral findings

Periurethral findings	No. of cases
Hematoma/collections	2
Periurethral abscesses	4
Diverticula	4
False passages	16
Urethrocuteaneous fistula	1

DISCUSSION

Retrograde urethrography has been the standard imaging technique for the evaluation of male anterior urethra, which involves the use of radiation and contrast medium. It gives very limited information about periurethral structures. Radiation is harmful especially to the gonads which are frequently exposed during these examinations.

An ideal study should be able to indicate the type of surgical procedure suitable for the patient. This includes accurate determination of the site, length and diameter of strictures. Complete preoperative knowledge of complicating conditions like urethral calculi, fistulae, false tracts, diverticula and polyps facilitate favorable urethroplasty outcomes.

For this study, the sonourethrographic imaging was performed with the urethra distended by normal saline as a negative contrast agent. Bearcroft P.W.P. and Berman L.H⁸ used radiographic contrast medium immediately after the contrast study. If no contrast study is to be performed it was replaced by normal saline.

Initial studies described dorsal scanning approach to the penile urethra^{3,9,10} moving ventrally for subscrotal and perineal views of the bulbar urethra. These studies however used 5 MHz transducer and near-field artifact was a problem. Despite the penile urethra appearing in the extreme near field, we found that ventral approach was preferable with the penis extended along the lower abdomen. This enabled the longitudinal scans to be accomplished in a single rapid sweep. Near field artifact was abolished by using a high frequency probe (10 MHz).

Table 7: Statistical evaluation of study

Sr. no.	Character	SEN (%)	SPE (%)	PPV (%)	NPPV (%)	K value	Agreement
1	Location of stricture	97.73	93.75	97.73	93.75	0.90	Very good
2	Number of strictures	97.73	93.75	97.73	93.75	0.94	Very good
3	Length of strictures	97.73	93.75	97.73	93.75	0.92	Very good
5	Diverticula	100	98.20	75.00	100	0.85	Very good
7	False passages	100	100	100	100	1.00	Very good
8	For all urethral pathologies	98.96	96.21	78.88	98.87	0.88	Very good

Sen- Sensitivity, Spe- Specificity, PPV- Positive predictive value, NPV- Negative predictive value, K value- kappa value

We used digital panoramic reconstruction of the ultrasound images to facilitate comparison of SUG with RGU.

Out of 60 patients studied most patients belonged to 3rd decade with average age of the patients being 36.33 year (Table 1, Figure 1). Chiou R.K. et al., Bearcroft P.W.P. et al., Gluck C.D. et al., Gupta S. et al., Samaiyar S.S. et al.^{4,8,9,11,12} also had mean age of patients around 3rd decade.

Location of Strictures

Locations of the strictures were categorized as penile, bulbar and membranous. One patient with penile stricture was diagnosed only on SUG and missed on RGU while another patient with bulbar stricture was diagnosed only on RGU. Rest of the stricture locations matched perfectly in both the studies.

The two complex penile and membranous strictures which were visualized on RGU and missed on SUG in patients were considered as false negative. McAninch JW et al., Bearcroft P.W.P. et al. and Gupta S. et al.^{3,8,11} had similar problem regarding the posterior urethra (membranous and prostatic), which is difficult to evaluate with SUG owing to its inability to scan the urethra in a perpendicular fashion.

One penile partial stricture missed on RGU was seen on SUG with periurethral fibrosis. Patient had stricture demonstrated at same site before the urethral dilatation on RGU. This stricture was considered false positive. Pushkarna R. et al.¹³ reported similar finding, one patient had normal RGU showed 2 mm stricture on SUG.

One bulbar stricture, which was demonstrated on RGU, was missed on SUG. Patient had bilateral large scrotal pyocele; this pyocele interfered with proper visualization of bulbar urethra. This stricture was considered false negative. In the rest of the patients location of stricture perfectly matches on both the modalities.

Strength of agreement between these two methods by kappa statistic for location of strictures was found to be 0.90, which means very good agreement. Sensitivity and specificity of sonourethrography for location of stricture was 97.73% and 93.75% respectively. Positive and negative

predictive values were 97.73% and 93.75% respectively (Table 7).

Number of Strictures

Out of 44 patients, 'single stricture' were found in 31 patients and 'complex' strictures in 13 patients. The 'single stricture' included three bulbar and three penile strictures which were multiple in numbers however they were at single location. The penile strictures included two strictures with associated membranous urethral strictures visualized on RGU missed on SUG.

Kappa value for number of stricture was 0.94 meaning very good agreement between SUG & RGU. Sensitivity and positive predictive value of SUG was 97.73% and specificity and negative predictive value was 93.75% (Table 7). There was good correlation of the complex strictures in both the techniques. All the previous studies showed good correlation of both the modalities regarding stricture number or multiplicity.^{4,5,9,12}

Length of Stricture

SUG diagnosed length of stricture with sensitivity of 97.73% and specificity of 93.75%. Positive and negative predictive values were 97.73% and 93.75% respectively. Kappa value for length of stricture was 0.92, which signifies very good agreement between SUG and RGU (Table 7).

When strictures were grouped according to anatomical sites, both techniques were equally sensitive in length estimation in the penile urethra. However, RGU correlated poorly with length of strictures in the bulbar urethra, underestimating the length in spite of radiographic magnification. Most previous studies show consistently poor correlation between RGU and SUG in estimating stricture length, especially for bulbar urethral strictures.¹⁴ This information gained using SUG in the penile urethra was not as helpful in clinical decision making as it was in the bulbar region because conventional radiographic RGU correlated closely with sonourethrographic and intraoperative findings in this area.⁵ Gupta et al.¹¹ in the study including 30 patients reported poor correlation between the two techniques in estimation of stricture length, RGU underestimating the length in most cases. S. Choudhary, P. Singh et al.¹⁵ in their study of

70 patients reported similar findings. Samaiyar S.S. et al.¹² found that contrast urethrography underestimated the length by 50% or by 0.6 mm, mainly in the bulbar region.

The accurate estimation of stricture length is important, as it is one of the factors that determine the suitable operative procedure. Earlier investigators, using standard radiographic imaging alone, proposed that only strictures 1 cm or less be selected for excision therapy.¹⁶ Because sonographic measurements are often longer, new ultrasonic criteria proposed indicate resection and end-to-end anastomosis for adult bulbar stricture measuring up to 25 mm.

The overall sensitivity of ultrasound in evaluation of stricture was found to be 97.73% and specificity was 93.75%. The predictive value of positive diagnosis in the present study was 97.73% and that of negative diagnosis was 93.75% (Table 7). Comparing this with the study by Heidenreich A. et al.¹⁷ showed sensitivity of 98% and specificity of 96% with positive and negative predictive values 98% and 96% respectively. Samaiyar S.S. et al.¹² had sonourethrographic accuracy of 96.44%.

Additional information was available about the periurethral region on sonourethrography like periurethral fibrosis.

Periurethral Fibrosis

There was no correlation between the presence of periurethral fibrosis and the severity of strictures. Periurethral fibrosis is a critical determinant of appropriate therapy and ultimate prognosis.¹⁶ Excessive fibrosis is said to be responsible for high recurrence rates.¹⁰

Other Periurethral Findings

Other findings such as periurethral hematoma, periurethral abscesses, diverticula and false passages were well seen on sonourethrography. However periurethral hematoma and periurethral abscesses were missed on RGU.

Diverticula were diagnosed by sonourethrography with 100% sensitivity and 98.2% specificity. Positive predictive value was 75% and negative predictive value was 100%. Degree of agreement calculated between SUG and RGU found to be Kappa value = 0.85 means very good agreement (Table 7).

Bearcroft P.W.P. et al.⁸ studied 24 patients of which 11 were normal. Three cases demonstrated diverticula however only two of these were seen on SUG. A shallow diverticulum was found in case of complex strictures only on contrast study. Alanen A, Nurmi M¹⁸ studied 16 male patients out of which one had diverticulum. Most of the previous studies underestimated these findings.

False passages were seen in 16 patients and one had urethrocuteous fistula. False passages were seen equally with both the methods, however careful evaluation of the periurethral structures and proper transverse scanning was needed.

Chiou RK et al.⁴ patients had inadequate evaluation in eight patients out of 35. Among 27 patients one had no stricture, another had urethrocuteous fistula without stricture and a case of false passage with short stricture. RGU were unable to demonstrate the origin of fistula however SUG identified the origin of fistula and delineated the extent of urethral and periurethral extent. Gupta S. et al.¹¹ were able to pick up 10 false tracts on retrograde urethrography and eight false tracts out of 10 on sonourethrography. Sonourethrography definitely have upper hand in evaluation of periurethral pathologies.

The complications encountered during RGU were contrast intravasation in one (1.6%) patient, pain during the procedure in one (1.6%), and urethral bleeding in one (1.6%) patient. One (1.6%) patient had chills during the procedure. No patients with contrast intravasation had adverse systemic reactions. Local burning pain occurred during retrograde injection of contrast medium. This subsided in all cases a few hours after the procedure. During sonourethrography, pain was experienced by one (1.6%) patient during inflation of the Foley bulb in the fossa navicularis and bleeding per urethra in one patient (1.6%). Sonourethrography certainly have added advantage of lesser degree of complications.

CONCLUSIONS

In the present study we have found sonourethrography to be a multiplanner, easily available and cost effective technique for evaluating the male anterior urethra without radiation exposure. It is an effective combination of high-resolution sonography and normal saline as a negative contrast agent.

When compared with conventional RGU, sonourethrography is equally efficacious in detecting anterior urethral stricture diseases. However, further characterization of strictures in terms of length, periurethral pathologies like periurethral fibrosis, diverticula, abscesses, fistulas and false tracts can be performed with relatively greater sensitivity using the sonourethrography.

Ability of sonourethrography to diagnose periurethral pathologies and length of stricture especially in bulbar urethra helps surgeon to plan proper surgical procedure. In conclusion, sonourethrography in experienced hand

can prove to be highly effective modality for diagnosis of anterior urethral obstructive pathologies like strictures.

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Pregnancy Outcome among Obese Indians - A Prospective Cohort Study in a Tertiary Care Centre in South India

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Abstract

Background: Obesity is a growing problem in the Asian subcontinent with Indians having increased propensity of developing obesity related complications like diabetes and hypertension later in life, notably at much lower levels of BMI than we have come to associate them with. The current study incorporates new Asian Indian guidelines for obesity in our pregnant women and assesses whether pregnancy complications are also similarly increased. There is a paucity of studies in this regard and hence the need for this study.

Aims & Objectives: To assess obesity related adverse outcome in pregnancy, in labour and immediate effects on the newborn using new Asian Indian guidelines for obesity.

Materials & Methods: 199 pregnant women attending JIPMER antenatal outpatient department at less than 16 wks of gestation were enrolled. They were subdivided into 3 groups: 99 in non-obese (BMI < 25 Kg/m²), 81 as obese (BMI: 25-34.9 Kg/m²), and 19 as morbidly obese (BMI ≥ 35 Kg/m²). Hypertensive disorders in pregnancy and GDM were main outcomes while total LSCS, instrumental deliveries, induction rates, macrosomia, PPH, shoulder dystocia, birth asphyxia and wound sepsis were also studied.

Results: There was a significant increase in gestational diabetes among morbidly obese (26%) and obese (17%) compared to non-obese (4%)(p = 0.0023). Significant association of hypertensive disorders (p < 0.0001) was seen with obesity with significantly increased odds of among obese (OR: 3.6) and morbidly obese (OR: 13.9). There was a significant increase in LSCS as well as instrumental deliveries. Macrosomia, PPH, birth asphyxia and puerperal wound sepsis were also significantly higher among obese.

Conclusion: Obesity defined by Asian Indian guidelines (BMI ≥ 25 Kg/m²) is associated with adverse outcomes in pregnancy, in labour and on the fetus at odds comparable to western studies with obesity taken as BMI ≥ 30 Kg/m².

Keywords: BMI, Diabetes, Hypertension, Obesity

INTRODUCTION

Obesity, the silent epidemic worldwide has reached a stage where approximately 2.3 billion adults will be overweight and more than 700 million adults will be obese by 2015, as projected by WHO.¹ National Family Health Surveys in India indicated an increase in obesity from 10.6% in 1998-1999 to 14.8% in 2005-06.

Recent studies have shown that Asian Indians have more pre-disposition for truncal obesity as opposed to

generalised obesity with increased amount of subcutaneous and intra-abdominal adipose tissue deposition as well as certain ectopic sites like in muscle and liver. Deurenberg-Yap et al.² determined absolute and relative risks for at least one cardiovascular risk factor (elevated triglycerides/hypertension/diabetes mellitus) for various categories of BMI and waist-hip ratio (WHR). Absolute risks for cardiovascular complications are high, ranging from 41 to 81% at low categories of BMI (22-24 kg/m²) and WHR (0.80-0.85)(Odds ratio: 1.97-4.38). Interestingly these complications appeared in categories of BMI and

WHR well below the cut-off values of BMI and WHR recommended by WHO. South Asians settled overseas also were at increased risk of insulin resistance and cardiovascular complications than white Caucasians matched for BMI.³ Hence experts met in New Delhi in 2008 to develop Asian Indian specific guidelines for defining and managing obesity.^{4,5} In proceedings of 9th International conference on obesity in Sao Paolo as well, this need of developing ethnicity related cut-offs for obesity based on BMI was accepted.

Currently recommended cut-offs of BMI by WHO¹

Normal	: 18.5-24.9 kg/m ²
Overweight	: 25.0-29.9 kg/m ²
Obesity	: ≥ 30 kg/m ²

Consensus meeting statement based on various studies all over India⁶

Normal BMI	: 18.5-22.9 kg/m ²
Overweight	: 23.0-24.9 kg/m ²
Obesity in Indians	: ≥ 25 kg/m ²

Gestational diabetes mellitus is a major complication in pregnancy associated with obesity. About 17% of obese women show GDM in pregnancy compared to 1-3% women in normal BMI.⁷ Hypertensive disorders of pregnancy are significantly higher among obese women. O'Brien *et al.*⁸ demonstrated that the risk of pre-eclampsia is typically doubled with every 5-7 kg/m² increase in prepregnancy BMI. According to RCOG obesity is the most important risk factor for thrombo-embolism in pregnancy. Risks of APH chiefly placental abruption are also increased with obesity. Obesity also increases chances of multifetal gestation and preterm labour.⁹

Sebire *et al.*⁹ showed that the caesarean section rate for obese women was over 20% compared to 10% for normal weight women. Shoulder dystocia and maternal injuries are increased with obesity.¹⁰ Usha Kiran¹¹ found that women with BMI ≥ 30 kg/m² were at increased risk of post dated pregnancy and induction of labour. Postpartum complications including PPH and lactational dysfunction are also increased.

Vricella *et al.*¹² reported significant risks of anaesthesia complications in obesity (insufficient duration of regional anaesthesia, increased conversions to general anaesthesia, need of additional I.V analgesia, increased rates of post-dural puncture headache, high spinal and profound intra-op hypotension.

Congenital anomalies mainly neural tube defects¹³ and congenital heart diseases¹⁴ are increased with obesity in pregnancy even after excluding chances of anomalies with

simultaneous diabetes. Hyperinsulinemia is the main risk factor along with elevated uric acid, endogenous estrogen and triglycerides.¹⁵

MATERIALS AND METHODS

This was a prospective cohort study undertaken in the department of Obstetrics & Gynaecology in JIPMER, Pondicherry - a tertiary care hospital in southern India for a period of two years. There were two exposure groups of pregnant women: one with BMI < 25 kg/m² and second with BMI > 25 kg/m² matched for gestational age and parity. It was approved by institutional ethics committee. Informed consent was obtained from all the participants of the study.

Sample size

The sample size was estimated using the standard formula by Limeshow *et al* (1990). To calculate the sample size, hypertensive disorders in pregnancy was considered as the main variable and the relative risk was taken as 1.92 in BMI > 25 kg/m² group as compared to < 25 kg/m².¹⁶ The sample size was estimated with 80% power at 5% level of significance. The minimum sample size required for this study was estimated as 80 in each group.

Pregnant women up to 16 wks of gestation on first visit to JIPMER antenatal outpatient were enrolled over a period of 1 year from October 2010 to September 2011. Women with pre-existing hypertension, diabetes and thrombophilias were excluded. Multiparous obese women undergoing caesarean section in present pregnancy due to doubtful previous LSCS scar integrity were also not included under total caesarean section parameter of pregnancy outcome.

Hypertensive disorders in pregnancy and GDM were primary outcomes studied while instrumental deliveries, total caesarean sections, multiple gestation, preterm labour, APH, abortions and stillbirths, maternal injuries and shoulder dystocia during labour were secondary outcomes. Congenital anomalies, macrosomia in newborn was also assessed. Puerperal sepsis and venous thrombo-embolism if any was assessed.

Brief procedure

BMI was calculated in their first visit (wt in kg/ht in m²) along with their blood pressure. The women attended prenatal care every month until 28 weeks of pregnancy, fortnightly henceforth till 36 weeks and weekly thereafter till delivery. Gestational diabetes was estimated by 50 gm GCT at 24-28 weeks followed by GTT as per NDDG guidelines if 1 hr GCT value exceeded 140 mg/dl. Antepartum haemorrhage was defined as bleeding from or

into the genital tract after 28 weeks of gestation. Preterm delivery was defined as delivery prior to 37 completed weeks. Macrosomia was defined by birth weight 4000 gms or greater. Low APGAR score was considered by a score less than 5 at 1 minute. Follow-up was done till delivery & labour and perinatal outcomes assessed till postnatal day 7.

Chi-square test was used to compare the categorical data between the groups. The Kolmogorov-Smirnov Test was used to test the distribution of continuous variables and accordingly appropriate parametric (Independent Students t test) or non parametric (Mann Whitney U test) test was used for comparing the continuous variables. Odds ratios were calculated to approximate relative risks of BMI on adverse outcomes. All statistical analyses were done at 95% confidence interval and the P value of <0.05 was considered as statistically significant.

RESULTS

A total of 199 women were included with 99 fulfilling the inclusion criteria in BMI <25 kg/m² non-obese group. One hundred women were enrolled in ≥ 25 kg/m² group as obese. Thirty six women were lost to follow up and were excluded. Obese women were further subdivided as follows (Figure 1):

- 81 patients with BMI between 25-34.9 Kg/m² (obese)
- 19 patients with BMI ≥ 35 Kg/m² (morbidly obese)

The mean age (23.49 ± 3.9 in non-obese and 24.86 ± 3.9 in obese) and parity in both the groups was similar.

The overall incidence of gestational diabetes (GDM) among the study subjects was 11.5% and GDM increased with increase in BMI ($P < 0.05$). The incidence of GDM among morbidly obese (26%) and obese group (17%) was significantly higher with an OR of 8.5 and 5 respectively when compared with normal group (Table 1). The overall incidence of hypertensive disorders was 38% and it was significantly associated with increasing BMI (Figure 2). The Odds Ratio (OR) for the hypertensive disorders among the study subjects in morbidly obese and obese in comparison with normal BMI subjects was 13.9 and 3.6 respectively.

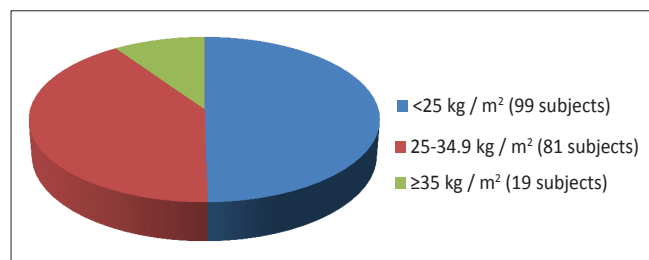


Figure 1: Distribution of study subjects

The incidence of gestational hypertension (GHT) and pre-eclampsia/eclampsia among study subjects is 28.4% and 18% and it is significantly higher in obese compared to normal subjects (Table 2). The rate of IUGR (Table 3) was higher in morbid obese (21%) when compared with obese (8.65%) and normal group (8.1%). The OR of the IUGR in morbid obese was 3.03 when compared to the normal and the OR in obese group was 1.08. The abortion rate among the study subjects was 2% and the abortion rates were comparable between the BMI groups (Table 3) as were multiple gestation, APH and preterm deliveries (Table 4). 37% were induced and it increased with increase in BMI (OR: 1.3 and 3.9) with statistical significance seen with morbid obesity.

27% of all underwent LSCS and the proportion of LSCS significantly increased with increase in BMI (Table 4). Of all the women undergoing LSCS, 78% underwent emergency LSCS (Table 5). Emergency LSCS was particularly increased with increasing BMI (OR: 2.6 and 7.6). Cephalopelvic disproportion was the predominant cause of elective LSCS among obese women while fetal distress (72%) and failed induction of labour (22%) main causes for emergency LSCS. The overall instrumental delivery rate was 18.9%. The rates in morbid obese (37.5%) and obese (27.1%) was significantly higher than in normal group (11%) ($P < 0.05$) (Table 4).

The incidence of maternal injuries was 4%. The incidence of macrosomia in morbidly obese group was 10.53% which was significantly higher when compared to normal group (1.02%) but it was not significantly different in comparison with obese group (2.47%). The mean birth weight among obese women was 2840 grams compared to 2630 grams among non-obese. There were no cases of shoulder dystocia in morbidly obese group with caesarean section being done for the macrosomic fetuses in that group which accounts for the non-significant association between obesity and shoulder dystocia (Table 3). Overall incidence of PPH was 6.5% and it significantly increased with increasing BMI (OR: 3.2 and 22.4 with obesity and morbid obesity).

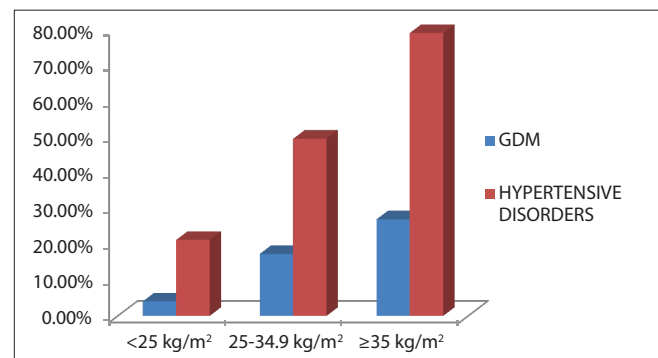


Figure 2: Distribution of GDM and hypertensive disorders among study groups

Table 1: Obesity, GDM and hypertensive disorders

Groups	GDM present	OR (95% CI)	Hypertensive disorders	OR (95% CI)
<25 kg/m ²	4 (4.05%)	Reference	21 (21.2%)	Reference
25-34.9 kg/m ²	14 (17.29%)	5 (1.564-15.75)	40 (49.4%)	3.6 (1.89-6.94)
≥35 kg/m ²	5 (26.92%)	8.5 (2.63-35.44)	15 (78.9%)	13.9 (4.12-46.43)

Table 2: Gestational hypertension and pre-eclampsia in different groups

BMI category	GHT (%) ^a	OR (95% CI)	PE/Eclampsia(%) ^b	OR (95% CI)	Total
<25 kg/m ²	15 (16.1%)		6 (7.14%)		99
25-34.9 kg/m ²	24 (36.9%)	2.36 (1.14-4.88)	16 (28.1%)	5.07 (1.84-13.95)	81
≥35 kg/m ²	10 (71.4%)	6.22 (2.12-17.87)	5 (55.55%)	16.25 (3.43-76.07)	19
Total	49 (28.4%)		27 (18%)		199

a-excluding pre-eclampsia/eclampsia, b-excluding gestational hypertension

Table 3: Fetal complications and obesity

Fetal complications	BMI categories	Total (%)	OR (95% CI)
IUGR	<25 Kg/m ²	8 (8.1%)	
	25-34.9 kg/m ²	7 (8.65%)	1.08 (0.37-3.11)
	≥35 kg/m ²	4 (21.1%)	3.03 (0.81-11.34)
Abortions	<25 Kg/m ²	3 (3%)	
	25-34.9 kg/m ²	1 (1%)	
	≥35 kg/m ²	0	
Perinatal mortality	<25 Kg/m ²	7 (7.1%)	
	25-34.9 kg/m ²	7 (8.65%)	
	≥35 kg/m ²	2 (10.53%)	
Congenital malformations	<25 Kg/m ²	1	
	25-34.9 kg/m ²	3	
	≥35 kg/m ²	1	
Macrosomia	<25 Kg/m ²	1 (1.02%)	
	25-34.9 kg/m ²	2 (2.47%)	2.48 (0.22-27.89)
	≥35 kg/m ²	2 (10.53%)	11.5 (0.99-134.4)
Shoulder dystocia ^c	<25 Kg/m ²	1 (1.2%)	
	25-34.9 kg/m ²	4 (6.78%)	
	≥35 kg/m ²	0	
Birth asphyxia	<25 Kg/m ²	15 (15.1%)	
	25-34.9 kg/m ²	19 (23.4%)	1.74 (0.81-3.64)
	≥35 kg/m ²	8 (42.1%)	4.07 (1.41-11.8)

c-percentage calculated after excluding LSCS

(Table 4). Birth asphyxia was also significantly increased with morbid obesity (OR: 4.7). Perinatal mortality rates were comparable in the three groups. While no significant association was found between the congenital anomalies and obesity, the sample size was also small for the purpose. Likewise there was not a single case with venous thrombo-embolism among the study subjects.

The overall prevalence of wound sepsis (including post LSCS wound discharge and episiotomy wound gape) was 5%. It increased with obesity (OR: 3.2) significantly among the morbidly obese (OR: 9.1).

DISCUSSION

Risk of GDM was observed with obesity (OR: 5) with odds rising to eight fold with morbid obesity similar to other

Table 4: Other maternal complications and obesity

Maternal complications	BMI categories	Total (%)	OR (95% CI)
LSCS ^x	<25 Kg/m ²	13 (14.6%)	Reference
	25-34.9 kg/m ²	22 (33.8%)	2.99 (1.37-6.5)
	≥35 kg/m ²	11 (68.7%)	12.86 (3.84-43.13)
APH	<25 Kg/m ²	2 (2%)	
	25-34.9 kg/m ²	2 (2.47%)	
	≥35 kg/m ²	2 (10.53%)	
Multiple gestation	<25 Kg/m ²	2 (2.03%)	
	25-34.9 kg/m ²	7 (8.65%)	
	≥35 kg/m ²	1 (5.27%)	
Preterm delivery	<25 Kg/m ²	12 (12.13%)	
	25-34.9 kg/m ²	14 (17.29%)	1.5 (0.66-3.49)
	≥35 kg/m ²	3 (15.79%)	1.4 (0.34-5.37)
Induction of labour ^a	<25 Kg/m ²	31 (31.6%)	
	25-34.9 kg/m ²	30 (38.9%)	1.3 (0.69-2.4)
	≥35 kg/m ²	9 (64.2%)	3.94 (0.93-18.6)
Instrumental deliveries ^b	<25 Kg/m ²	10 (11.6%)	
	25-34.9 kg/m ²	16 (27.11%)	2.83 (1.98-6.78)
	≥35 kg/m ²	3 (37.5%)	4.56 (0.94-22.06)
Maternal injuries	<25 Kg/m ²	3 (3%)	
	25-34.9 kg/m ²	2 (2.5%)	
	≥35 kg/m ²	3 (15.3%)	
PPH	<25 Kg/m ²	2 (2.1%)	
	25-34.9 kg/m ²	5 (6.2%)	3.2 (0.6-16.9)
	≥35 kg/m ²	6 (31.6%)	22.4 (4.08-122.8)
Wound sepsis	<25 Kg/m ²	2 (2%)	
	25-34.9 kg/m ²	5 (6.2%)	3.2 (0.60-16.9)
	≥35 kg/m ²	3 (15.8%)	9.1 (1.41-58.78)

x-excluding instrumental deliveries, a-percentages and odds calculated after excluding elective LSCS in each BMI groups, b-percentages and odds calculated after excluding LSCS from BMI groups

studies.¹⁷ Along with hyperinsulinemia, maternal obesity is associated with hyperlipidemia, which enhances oxidative stress with decreased prostacyclin and more peroxide production, resulting in vasoconstriction and platelet aggregation, which increases the risk of hypertensive disorders of pregnancy. With a fourfold increase in hypertensive disorders, this study estimated a significant increase in gestational hypertension and pre-eclampsia similar to other studies.^{16,18} Increase in risk of antepartum haemorrhage was noticed in morbidly obese women, chiefly due to placental abruption. Cedergren¹⁸ however

Table 5: LSCS in BMI groups

Groups	Elective LSCS(%) ^x	OR (95% C I)	Emergency LSCS(%) ^y	OR (95% C I)	Total
<25 kg/m ²	1 (1.3%)		12 (13.6%)		13
25-34.9 kg/m ²	4 (7%)	5.74 (0.62-52.8)	18 (29.5%)	2.65 (1.16-6.02)	22
≥35 kg/m ²	5 (50%)	76 (7.4-781.5)	6 (54.5%)	7.6 (2.02-28.86)	11
Total	10		36		46

x-excluding instrumental deliveries and emergency LSCS, y-excluding instrumental deliveries and elective LSCS

could not find any increased risk for placental abruption in his study with much larger numbers of morbidly obese women. Placenta previa too was less frequent in other studies.^{19,20}

Odds for IUGR was increased but no significant association of multiple gestation with obesity (p : 0.13); a trend also noticed in other studies.²¹ There was no increased risk of preterm labour which was an outcome similar to other studies with a small sample size. Bodnar had demonstrated increased risk of spontaneous and idiopathic preterm births with weight loss in class 1 and 2 obese women.²² Hendler²³ had predicted fewer total and spontaneous preterm births with maternal prepregnancy BMI ≥ 30 Kg/m².

Morbidly obese women were more likely to undergo induction of labour (OR: 3.9). High rates of induction for postdatism and oligohydramnios even in non-obese women might account for the non-significant association with obesity (OR: 1.3 in obese compared to non-obese). Usha Kiran¹¹ however had found that women with BMI ≥ 30 kg/m² were at increased risk for postdated pregnancy (OR: 1.4) and hence induction of labour (OR: 1.6).

Obesity was a significant risk factor for both elective and emergency c-sections with odds increased manifold with morbid obesity. Fyfe et al.²⁴ reported significant risk of prelabour c-sections (p = 0.02) as well as increased rates of caesarean delivery in first stage (OR: 2.89) among obese. They reported similar rates of second stage c-sections among both obese and non-obese.

Rode et al.²⁵ had demonstrated a fivefold increase in odds of instrumental deliveries among obese similar to this study. Sahu et al.²⁰ had reported significantly higher rates of macrosomia among morbidly obese women (p = 0.02). Sheiner et al.²⁶ felt that after having adjusted for diabetes mellitus, no significant association was found between macrosomia and obesity alone. Besides, Catalano²⁷ had already demonstrated that GDM can be a confounding factor in a study between macrosomia and obesity. In our study there was a significant association between macrosomia and morbid obesity (OR: 2.48 and 11.5 in obese and morbidly obese respectively). In spite of the higher rates of macrosomia, there was no significant increase in shoulder dystocia as most of the obese mothers

with macrosomia underwent LSCS. There was also no significant increase noted with perineal tears, c-section angle extensions and other maternal injuries among obese in our study (p > 0.05).

Postpartum haemorrhage (atonic) rates were significantly raised with obesity in our study. Prolonged duration of labour, increased instrumental deliveries and c-sections were directly related to atonicity. Sebire et al⁹ reported a 44% increased risk of PPH with BMI > 30 Kg/m². Cedergren felt this increase in PPH may be due to increased surface area of placental implantation associated with LGA babies while Nuthalapathy²¹ felt it could be due to large volume of distribution and decreased bio-availability of uterotonic agents in obese women. Birth asphyxia with or without convulsions was significantly seen among newborns of obese women in this study (p = 0.02). No significant association with perinatal mortality was however noted. Cedergren¹⁸ demonstrated an increased risk for meconium aspiration and birth asphyxia among newborns of obese (OR: 2.85 and 2.52 respectively).

Wound sepsis rates were significantly raised (p = 0.03) in morbidly obese women. Alanis et al.²⁸ had demonstrated higher risks of post caesarean wound gape, discharge and seroma formation among the morbidly obese. There was no maternal mortality in the present study. With limited puerperal follow-up, no cases of venous thromboses were seen in any of the groups.

CONCLUSION

Pregnancy complications related to obesity is a growing problem with complications arising at a BMI ≥ 25 Kg/m² at rates comparable to western definition of obesity (BMI ≥ 30 Kg/m²). This study reflects the need of new Indian guidelines of weight restriction to be taken more seriously and a larger, prospective trial taking ethnic differences into consideration, is the need of the hour. The small sample size and short span of this study as well as the selection bias associated with a tertiary care institute are limitations. Division of obese women into obese (BMI 25-34.9 Kg/m²) and morbidly obese (≥ 35 kg/m²) was a bit arbitrary considering lack of categorical definition in new Asian Indian guidelines, however was necessary for

better interpretation of results and was similar to other studies.^{16,29}

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Assessment of Oral Health Status in Children Suffering from Nephrotic Syndrome

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Abstract

Introduction: Nephrotic Syndrome is one of the chronic illnesses in the paediatric age group. Advances in paediatric nephrology in recent years have resulted in a marked increase in the number of children surviving with chronic renal failure. The aim of this study is to assess the oral hygiene status of children suffering from Nephrotic syndrome.

Materials and Methods: 100 children within the age group of 4 years to 17 years, suffering from Nephrotic Syndrome were examined and the oral health status of each patient was evaluated based on a questionnaire, DMFT index, dmft index, gingival index and oral hygiene index.

Results: 68% male predominance was seen; 11% children in the age range of 12-17 years and 17% children in the age range of 4-11 years had dental caries. 66% children had mild inflammation of the gingiva; 58% children had poor oral hygiene index; 26% children had mucosal lesions (Aphthous ulcers).

Conclusion: Higher plaque accumulation and gingival inflammation was observed in these children along with reduced caries prevalence, and mucosal lesions (Aphthous ulcers). The findings of the present study indicate that there is a need for dental health education for children with Nephrotic Syndrome. Dental and medical care should be closely integrated to avoid conditions such as gingival problems, inspite of low caries incidence in children with Nephrotic Syndrome.

Keywords: Oral health, Nephrotic syndrome

INTRODUCTION

For more than two centuries Chronic renal disease and renal failure have been recognised as significant medical problems and were considered to be one of the most fatal diseases.¹ Various factors can result in renal failure and Nephrotic syndrome is just one of them.

Nephrotic syndrome (NS) is a serious medical condition which is characterized by swelling, large amounts of protein in the urine (usually no less than 3.5 g/dl), hyperlipidaemia, hypoproteinaemia, decreased protein in the blood and high cholesterol levels. It indicates the glomerulus is damaged and filtration function is impaired seriously.

Glomerular Filtration Rate (GFR) is the common medical index used to reflect kidney function and the normal range of it is 100 to 130. For people with kidney problem, the higher the GFR, the better the kidney function. Glomerular

filtration function decides patient's Glomerular Filtration Rate (GFR) directly, so for patients with Nephrotic Syndrome, the severity of their symptoms usually reflects their GFR.

Nephrotic Syndrome may have different causes depending on the child's age and with varying outcomes and symptoms at all ages. When the proteinuria exceeds 1000 mg/m² per day or spot (random) urinary protein-to creatinine ratio exceeds 2 mg/mg it is known as Nephrotic range proteinuria. The proteinuria in childhood nephrotic syndrome constitutes primarily albumin and is relatively selective.² In recent years advances in pediatric nephrology have resulted in a marked increase in the number of children surviving with chronic renal failure (CRF).

Various studies have reported enamel hypoplasia, enamel opacities, uremic stomatitis, oral bleeding, decreased periodontal disease, reduced salivary flow, xerostomia,

an increased tendency for calculus deposition reduced prevalence of caries, bad metallic taste, ammonia odour, as the oral changes seen in patients with chronic renal failure (CRF) and End stage renal disease (ESRD).^{3,4}

While diagnosis of mucosal lesions, dental caries and the status of the periodontal condition in the oral cavity is an essential part of dental practice, there are relatively few systematic studies of oral health status in children with Nephrotic Syndrome.

So taking the above aspects into consideration along with the available scattered reports and the scarcity of available data in the Karnataka region, the present study is undertaken to assess the prevalence of mucosal lesions, dental caries and gingival status in children suffering from Nephrotic syndrome and to plan a better dental care for these children.

MATERIALS & METHODS

The study to assess the oral health status in children with Nephrotic Syndrome was conducted at Indira Gandhi Institute of Child Health, Bangalore, Karnataka, India. The study was reviewed and ethical clearance was obtained from the institutional ethical committee. Signed written informed consent was obtained from the parents/guardians of the children participating in the study.

The study consisted of 100 diagnosed cases of Nephrotic syndrome in the age group of 4 to 17 years. Children with other systemic disorders and who had received dental treatment earlier were excluded from the study.

In each child, a detailed case history was taken which included age of onset, frequency of hospitalization, dialysis, history of blood transfusion, hepatitis and treatment advised followed by assessing the extra oral and intraoral findings.

The patients were on a low protein, sodium, phosphorus, potassium and high carbohydrate diet.

RESULTS

The present clinical study was conducted to assess the oral health status of 100 children suffering from Nephrotic Syndrome, within the age group of 4-17 years. The data obtained from the questionnaire and the observations were compiled and results were statistically analysed.

The mean age was 10.5 years and the maximum number of patients i.e. 35 (35%) were in the age group of 4-7 years comprising of 68 (68%) males and 32 (32%) females.

83 (83%) children in the study had a history of breast feeding and 25 (25%) children were sleeping at night using the bottle as a pacifier.

The parents of the children were asked regarding the amount of sugar consumption in the diet (6-8 spoons of sugar/day) and it was found that 26 (26%) children were exposed to sugar more than thrice daily and 15 (15%) children had sugar exposure thrice daily.

With regard to oral hygiene habits it was seen that 18 (18%) children did not brush their teeth daily as they were bed ridden and also used their finger to brush whenever possible. Only 26% children brushed twice or more in a day while only 5 (6%) children performed tooth brushing under parental supervision.

Decayed-Missing-Filled Index (DMF) was introduced by Klein, Palmer and Knutson (1938), modified by WHO in 1986 was used to assess the dental caries status. DMFT and dmft indices were used for the permanent and primary dentition respectively.

In the permanent dentition (DMFT), 21 (75%) children in the present study were found to have sound teeth (score 0) whereas 3 (11%) children had decayed teeth (score 1) and 4 (14%) children had missing teeth (score 4) due to caries (Table 1).

In the primary dentition (dmft), 36 (49%) children had sound teeth (score A) while 17 (23%) children had decayed teeth (score B) and 19 (26%) children had teeth missing (score E) due to caries. (Table 2).

The Modified Gingival Index (MGI), devised by Lobene et al. in 1986, a non-invasive (no probing) method

Table 1: DMFT index

DMFT index	n	%
Score 0	21	75%
Score 1	3	11%
Score 2	0	0%
Score 3	0	0%
Score 4	4	14%
Total	28	100%

Table 2: dmft index

dmft index	n	%
Score A	36	49%
Score B	17	23%
Score C	0	0%
Score D	0	0%
Score E	19	26%
Total	72	100%

to rate mild and moderate inflammation was used to assess the gingival status. 66 (66%) children showed mild inflammation (score 2) of the entire gingiva and 25 (25%) children showed very mild inflammation (score 1) of the gingiva with slight color change and 9 (9%) children showed moderate inflammation (score 3) of the gingiva (Table 3).

Simplified Oral Hygiene Index given by John. C. Greene and Jack. R. Vermillion in 1964 was used to assess the oral hygiene status which is an indication of oral cleanliness.

58 (58%) children had poor oral hygiene and 37 (37%) children had fair oral hygiene while only 5 (5%) children had good oral hygiene (Figures 1 and 2), (Table 4).

26 (26%) children had mucosal lesions (Aphthous ulcers) whereas 74 (74%) children did not have mucosal lesions (Figure 3), (Table 5).

DISCUSSION

Nephrotic Syndrome is one of the chronic illnesses in the pediatric age group. Dental management of children with Nephrotic syndrome begins with prevention of dental disease and thus maintenance of a caries-free dentition.

Many studies related to oral health status of those with chronic renal disease have been reported but as per the available data, there are no studies conducted regarding the

oral health status of the children suffering from Nephrotic syndrome.

In more than 90% of renal patients oral symptoms are observed as the disease itself and its treatment have systemic and oro-dental manifestations. Various studies have investigated elements of caries, higher prevalence of dental calculus, periodontal health, enamel defects, delayed eruption, bone lesions and oral-health-related quality of life and have stated disturbed calcium and phosphate metabolism to be the reason for such changes in patients with Chronic renal failure.^{4,5}

In the present study, 100 children were in the age range of 4-17 years with a mean age of 10.5 years. This is comparable to 10.86 years as reported by Fahnur Ertugrul, Cigdem Elbek- Cubukcu,³ 10.50 years as reported by L. Perteu, Mihaela Munteanu. Nephrotic syndrome has the same symptoms at all ages, yet depending on the child's age it may have different causes with varying outcomes.

This study comprised of 68% males and 32% females. Thus, a higher incidence of Nephrotic Syndrome was observed in males. Similar male predominance was reported by Khadija Herwis and Kumar Raghav.¹

Dental caries was the most common outcome investigated in studies related to oral health of individuals with chronic renal failure in the literature review.

The severity of caries is represented by the mean number of decayed, missing or filled teeth. In the present study, 11% children in the permanent dentition (DMFT) and 17% children in the primary dentition (dmft) had dental caries.

Similar outcome of reduced caries prevalence was also reported by Fahnur Ertugrul, R. Proctor and various authors.^{1,3,4,6-9}

Reduced caries prevalence in children with Nephrotic syndrome maybe attributed to the factor that the pH of the saliva is elevated by the urea present in it, possibly minimising the effect of any acid formation by the cariogenic bacteria resulting from sugar intake. This mechanism also decreases caries because of its antibacterial properties and its inhibitory effect on plaque formation. Also, the high salivary phosphate concentrations found in patients with uremia facilitate remineralization of incipient carious lesions.⁶

Children with Nephrotic syndrome are at high risk of developing poor gingival health which is a consequence

Table 3: Gingival index

Gingival index	n	%
Score 0	0	0%
Score 1	25	25%
Score 2	66	66%
Score 3	9	9%
Score 4	0	0%
Total	100	100%

Table 4: Oral hygiene index-simplified

OHI-S	n	%
Score 0 (good)	5	5%
Score 1 (fair)	37	37%
Score 2 (poor)	58	58%
Total	100	100%

Table 5: Mucosal lesions

Mucosal lesions	n	%
Absent	74	74%
Present	26	26%
Total	100	100%

of neglected or insufficient tooth brushing. Although the evidence is sparse, it appears that there has been a low frequency of periodontal or gingival disease reported in children with CRF. There are several possible reasons for this, including confounding factors, such as lifestyle differences, oral hygiene practices, biological determinants like difference in underlying susceptibility.

Periodontal conditions of patients with chronic renal failure were investigated by Khadija Herwis, Kumar Raghav and various authors.^{1,3,4,6,7,9} However, majority of these studies including the present study have used a visual index of inflammation with no probing depth or loss of attachment measurements being carried out.

Immunosuppression and uremia associated with CRF and hemodialysis may alter the inflammatory response of gingival tissue to the bacterial plaque. Also the inflammatory signs of gingiva may mask the pallor caused by anaemia [common systemic manifestation of reduced renal function].⁴

In this study, 66% children showed mild inflammation of the entire gingiva. Similar findings were also reported by B. Seraj, R. Ahmadi and other authors.³⁻⁵ Their findings concluded that the lack of inflammatory response could be due to the suppression of the inflammatory markers or due to decreased level of haemoglobin that leads to paleness of the gingivae despite the presence of marked inflammation. These findings were mostly seen in patients with low socioeconomic status and a low level of education which indicate that there is a need for dental health education for all children and their families.

Several authors like N. Kumar and A. Stein have evaluated calculus levels to determine the oral hygiene status in patients with Chronic renal failure.^{4,6,8} Martins reported that calculus formation was prevalent in 86.6% of CRF children and in healthy controls 46.6%.¹⁰

In this study 58 (58%) children had poor oral hygiene and only 5% had good oral hygiene.

Abundant calculus formation is rarely seen in healthy children; however, children with chronic renal failure demonstrate an elevated level of calculus. Alterations in salivary Ca, P, Mg, oxalate (Ox), urea and pH levels is seen in patients suffering from chronic kidney disease. Ca-P and Ca-Ox precipitation and dental calculus formation is seen mainly due to elevated salivary pH, in addition to decreased salivary Mg and a higher concentration of salivary urea and phosphorus. Lingual surface of lower incisors are the most prevalent site for calculus formation, due to their proximity to the submandibular glands orifices, which

act as a reservoir of Ca and P ions. However, abundant calculus formation may also be observed in other parts of the oral cavity.⁵ It is imperative that parents are advised of the importance of oral care at the outset, and that preventive care is delivered as early as possible and is reinforced at every dental visit, so that the need for active treatment is minimal. In this way, groundwork in the young patients will set standards which, if maintained through adult life, will prevent dental and medical complications throughout life.



Figure 1: Abundant calculus formation seen on the lingual surface of mandibular teeth



Figure 2: Accumulation of calculus seen in the labial surface of mandibular teeth



Figure 3: Mucosal lesion - Aphthous ulcer

26% children in this study had mucosal lesions (Aphthous ulcers) whereas 74% children did not have mucosal lesions. A high prevalence of uremic factor, xerostomia, saburral tongue have been cited as the reasons for mucosa lesions in such patients.^{3,4}

A questionnaire was distributed to all the parents of the children which included details regarding the oral habits and dietary habits of children, and oral hygiene habits.

Ertugrul, Cigdem Elbek-Cubukcu,³ Yahya B, Bayramy Ali⁴; Khadija Herwis and Kumar Raghav¹ in their studies asked participants about oral hygiene practices and found oral hygiene to be an extremely neglected issue among these children who belonged to a low socioeconomic background mainly due to their strict treatment routine.

In the present study, out of 100 children, 83% children had history of breast feeding, 25% children used to sleep in the night using the bottle as a pacifier, 18% did not brush their teeth as they were bed ridden and only 26% of children brushed their teeth twice or more times a day.

CONCLUSION

The present study was undertaken to assess the oral health status in children with Nephrotic syndrome and an attempt to understand the possible complications and predict prognosis.

However, the findings of this study regarding the global trends in clinical manifestation, severity, patients care, parent's attitude about the disease did not show any greater

variations as compared to other studies reported based on similar criteria.

Reduced caries prevalence, poor oral hygiene and mucosal lesions (Aphthous ulcers) were found in this study. Children undergoing strict treatment routines have got less time for preventive or treatment procedures regarding their oral ailments; therefore, the incorporation of dental service into their medical program and oral hygiene care may be crucial.

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Comparison of Mean Platelet Volume, Platelet Count, Total Leucocyte and Neutrophil Counts in Normoglycemics, Impaired Fasting Glucose and Diabetics

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Abstract

Introduction: Diabetes mellitus is a global pandemic and a complex disease characterized by chronic hyperglycaemia, metabolic abnormalities, long term macro – microvascular abnormalities involving the blood vessels, eyes, kidneys and nerves. Platelet parameters such as high platelet count and mainly high mean platelet volume (MPV) have been reported in diabetic patients, contributing to the increased risk of vascular disease. Also recent studies have documented the role of platelet – leukocyte aggregates in diabetics contributing to the vascular injury. The objective of our study is to study the simple variables of platelet count, MPV, total WBC count and neutrophil count not only in diabetics, but also in the normoglycemics and impaired fasting groups.

Materials and Methods: Current cross sectional study was conducted at Sapthagiri Institute of Medical Sciences and Research Center, Bangalore, India between the period of December 2013 to March 2014. A total of 248 cases were included in the study groups which were categorized as Group I, II, and III based on the fasting plasma sugar levels as normoglycemics, impaired fasting glucose and diabetics respectively. The same samples were run for MPV, platelet counts, Total leukocyte and Neutrophil counts.

Results: A statistically significant correlation was seen between the rising plasma glucose, MPV, Total Leukocyte count and the neutrophil counts. The platelet count however, did not show much statistical significance with rising glucose levels.

Conclusion: MPV, total leucocyte count and the absolute neutrophil counts increased proportionally with increasing plasma glucose levels. The variation was significant in diabetic group. Although the variation between the normoglycemics and impaired fasting group for the same variables was not very significant, the parameters still show increase with rising sugar levels.

Keywords: Diabetes mellitus, Impaired fasting glucose, Mean platelet volume (MPV), Platelets

INTRODUCTION

Diabetes is a global health problem associated with multiple disorders including metabolic, cellular and blood disturbances leading to vascular complications.¹ Platelets play a major role in integrity of normal haematopoiesis, and mean platelet volume (MPV) is an indicator for its function. The large platelets contain more dense granules are more potent than smaller platelets and hence more thrombogenic. Many studies have documented the findings of increased platelet count and mean platelet volume in diabetics. Impaired

fasting glucose (IFG) is also a frequent glycemic disorder in the general population, as is considered a pre-diabetic state.² Studies on mean platelet volume in patients with impaired fasting glucose and normoglycemics is limited in literature. We conducted this study considering the fact that in a country like India, MPV can be used as an important, effortless, simple and cost – effective tool for predicting the possibility of impending acute events. Also recent studies have documented a significant increase in platelet – leukocyte aggregates in diabetics.¹ The aim of the present study was to compare not only the mean platelet volume and

platelet count but also the total white blood cell count and relative neutrophil count in groups of normoglycemics, impaired fasting glucose group and in diabetics and assess the significance, thereby identifying factors which may be intervened to provide better patient care.

MATERIALS AND METHODS

We investigated a total of 248 patients falling under the normoglycemic, impaired fasting glucose and the diabetic category. Patients with abnormal platelet counts, (<100 and $>400 \times 10^3$ per micro liter), patients who were on anti-platelet medications (ticlopidine, clopidogrel and aspirin) were excluded. The diabetic category was a group of newly diagnosed cases, with patients on anti-diabetic therapy being excluded. Also excluded were males with Hb less than 13 g/dl and females with Hb less than 11.5 g/l as nutritional anemias can increase the MPV and cause reactive thrombocytosis. Patients with very low fasting blood sugar levels (< 70 mg/l) raised ESR and cholesterol levels were also excluded from the study.

Fasting blood samples were collected in the morning following overnight fast in EDTA & Fluoride vacutainers and samples were run for sugar and complete blood counts within half an hour to avoid sample variations on standing.

Blood glucose was tested using ERBA EM 360 automated biochemistry analyzer. The platelet count, MPV, Total leukocyte count and neutrophil count was done using PENTRA ES 60 Hariba five part analyzer. The patients were divided into three groups based on fasting plasma sugar (FBS) levels. Normoglycemics – 70-100 mg/dl Impaired fasting glucose – 101-126 mg/dl Diabetics - glucose of >127 mg/dl. The diagnostic criterion was that of American Diabetic Association. Platelet count, MPV, Total leukocyte count (TLC) and neutrophil count were compared among all the three groups.

Statistical Analysis

Present study was based on Descriptive and inferential statistical analysis. Results on categorical measurements are given in Number (%) and results on continuous measurements are expressed in Mean \pm SD (Min-Max) and Significance is assessed at 5% level of significance. The data took into consideration the assumptions that the Dependent variables are normally distributed, and samples drawn from the population are random, Cases of the samples are independent.

Analysis of variance (ANOVA) has been used to find the significance of study parameters between the three groups. Post-Hoc Tukey test being used to find the pair wise significance. The significance of study parameters on categorical scale between two or more groups was calculated using Chi-square/

Fisher Exact test Pearson correlation between FBS and other variables + Suggestive significance (P value: $0.05 < P < 0.10$)* Moderately significant (P value: $0.01 < P \leq 0.05$)** Strongly significant (P value: $P \leq 0.01$).

Statistical Software

The data analysis was done using the Statistical softwares namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver. 2.11.1.

RESULTS

Of the 248 patients, 122 (49.2%) were males and 126 (50.8%) were females. The gender distribution and the mean age in three groups were similar. The mean FBS in the normoglycemic group was 85.94 mg/dl, in the Impaired fasting group was 112.65 mg/dl and in the diabetic group was 201.49 mg/dl. The mean platelet counts in the three groups were 2.14 l/cmm, 2.21 l/cmm and 2.57 l/cmm respectively (Graph 1) The mean MPV in the three groups were 7.9 fl, 8.1 fl and 8.4 fl respectively. (Graph 2) (Table 1). The mean TLC (SI unit $\times 10^9/L$), absolute Neutrophil counts (SI units cells/ μL) in the three groups is given in Table 2. The platelet count, MPV, TLC and Neutrophil count in the three groups were compared using the ANOVA Turkey's HSD test (Table 3). The analysis showed that there is significant relationship between rising sugar levels and the variables, more so between the impaired fasting glucose (IFG) and the diabetics, the P value being significant for the MPV, TLC and Neutrophil counts.

The analysis showed increase in MPV, TLC and Neutrophil counts with increasing fasting plasma glucose levels, which was statistically significant.

DISCUSSION

Diabetes mellitus (DM) is a major health problem. Increased platelet activity is emphasized to play a role in the development

Table 1: Comparison of mean platelet count and MPV between the three groups

Mean \pm SD	Group I	Group II	Group III
MPV	7.91 \pm 0.82	8.10 \pm 0.75	8.42 \pm 0.56
Platelet count	2.14 \pm 1.18	2.21 \pm 2.04	2.57 \pm 0.56

MPV – P=0.013* Platelet – P=0.813

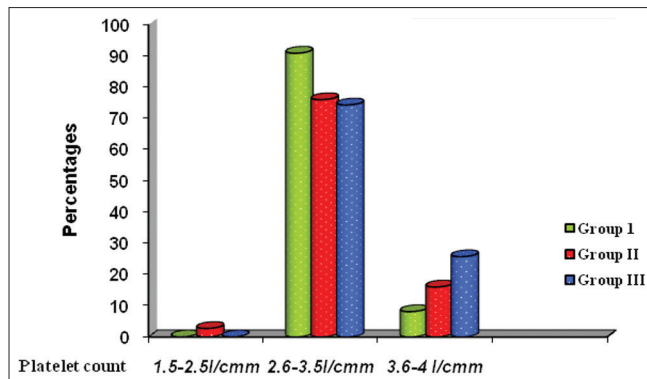
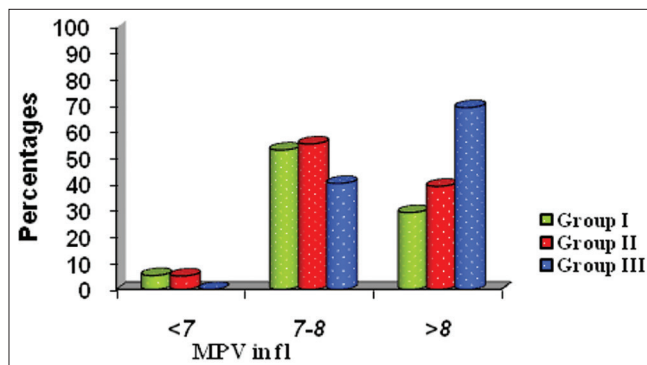
Table 2: Comparison of TLC and neutrophil count between the three groups

Mean \pm SD	Group I	Group II	Group III
TLC	6.76 \pm 1.87	6.82 \pm 1.68	7.83 \pm 1.69
Neutrophils	1205.65 \pm 5.21	1328 \pm 5.32	1560 \pm 6.29

P=0.006** and P=<0.001**

Table 3: Comparison of study variables according to three groups based on sugar levels

Variables	Results			Significance		
	Group 1	Group 2	Group 3	Group 2-I	Group 2-3	Group 1-3
Age in years	40.47±17.47	48.06±15.26	56.65±11.43	0.004**	0.002**	<0.001**
Gender (M:F)	45:54	40:35	37:37	0.303	0.684	0.554
Platelet counts	2.14±1.18	2.21±2.04	2.57±0.56	0.987	0.918	0.873
MPV	7.91±0.82	8.10±0.75	8.42±0.56	0.629	0.002**	0.010*
TLC	6.76±1.87	6.82±1.67	7.83±1.69	0.971	0.001**	0.001**
NEUTRO	1205.65±5.21	1328±5.32	1560±6.29			

**Graph 1: Platelet count distribution****Graph 2: MPV levels in three groups studied**

of vascular complications of this disorder.³ Mean platelet volume (MPV) can be used as a simple, economical test in the monitoring of DM, with many studies showing high MPV as a risk factor for the vascular complications of DM like thromboembolism, stroke and myocardial infection.⁴⁻⁸

In agreement with many previously conducted studies,^{9,10} our study also confirmed a higher MPV and platelet count in diabetics. One possible mechanism of increased MPV in DM is osmotic swelling due to raised blood glucose and its metabolites, due to the short life span of platelets in diabetes and also due to higher platelet turn over and younger platelets.^{11,12} The latter fact has been proved as MPV correlates with percentage of reticulated platelets and megakaryocyte ploidy, specially in diabetics. Platelets from patients with DM also have dysregulated signalling pathways that lead to an increased tendency to activate and aggregate in response to a given stimulus.¹³

Our institute being rural in location, patients often land up only when the sugar levels are high or when complications arise, and patients with prediabetic sugar levels are often lost to follow up. Our study with the previously mentioned reasons decided to include the normoglycemics and the impaired sugar level patients in the study to see the stepwise variation in MPV, Platelet count with rising sugar levels. This would facilitate in picking up mainly the vascular complications early, aiding in better patient care. There was a positive correlation in our study between increasing sugar levels and MPV in agreement with the study of Shimodaira et al.¹⁴

The categorization of the three groups was done according to the American Diabetes Association (ADA). According to ADA, impaired fasting glucose (IFG) is defined as 100-125 mg/dl of fasting plasma glucose, this lowered threshold done in 2003 for better prediction of future diabetes incidence.^{15,16} Other organizations like European Diabetes Epidemiology group (EDEG) and Japanese Diabetes Society (JDS), still retain the range for IFG as 110-123 mg/dl.¹⁴ In our study we stuck on stringently to the ADA criteria, in order to distinguish prediabetic subjects from normoglycemic subjects more efficiently. The present study found a significant correlation between platelet levels, MPV and increasing blood glucose levels.

The present study also took into consideration the relationship between rising fasting sugar levels along with the total leukocyte and neutrophil counts in the subjects. Evidence from epidemiological studies suggest a positive correlation between a peripheral total White blood cell count (WBC) a non specific marker of inflammation and diabetes risk.¹⁷⁻²⁰ Recent studies have postulated that hyperglycemia itself has an impact on white blood cell levels. This has further been proved by the lowering of blood glucose levels on treatment with drugs like rosiglitazone.^{17,21,22} Also increased levels of platelet leukocyte aggregates (PLA) have been described in diabetics, contributing to the microvascular injury.¹ Current study documented a higher TLC and neutrophil count with rising blood glucose levels, thereby supporting the recent hypothesis.

Abnormalities of lipid metabolism, particularly hypertriglyceridemia and low levels of HDL are almost

invariably found in patients with impaired glucose homeostasis, which can potentiate the platelet hyperactivity.²³ It must be finally noted that from the treatment aspect that antiplatelet drugs not only interfere with platelet activation in the setting of pathologic atherothrombosis, but also during physiologic thrombosis, thus questioning their role in the treatment of DM.

CONCLUSIONS

In present study, raised platelet counts and MPV are seen not only in diabetics, but a positive correlation has also been seen in subjects with impaired fasting glucose compare to normoglycemic controls. We also documented a positive correlation between rising blood glucose levels and total leucocyte count (TLC), being highest in the diabetic group. Platelet indices can be used as a simple, quick and effective tool to pick up early vascular complications in patient with impaired sugar levels, aiding in better patient care.

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A Retrospective Analysis of Reasons for Cancellation of Elective Surgery in a Teaching Hospital

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Abstract

Introduction: Unanticipated cancellation of scheduled elective operations decreases theatre efficiency and is inconvenient to the patients, their families and the medical teams. By knowing the reasons, appropriate steps can be implemented to reduce the rate of cancellations to a minimum.

Materials and Methods: This was a retrospective study. Scheduled elective general surgical procedures were reviewed from theatre records from June 2009 to May 2010. Operative cancellations were defined as those patients that were scheduled in the operative list, were shifted to the OR but did not have the planned surgery on the intended date.

Results: Out of 3618 scheduled surgeries, 246 (6.8%) were cancelled. The most common category for cancellations was surgeon related 106 (44.1%), followed by administrative 71 (29.5%), workup related 39 (16.2%), patient related 24 (10%). Case cancellations can be reduced by improving preoperative assessment, proper scheduling of cases and better interdepartmental coordination.

Conclusions: Appreciation of the reasons for cancellation on the day surgery can improve theatre utilization by permitting administrators and clinicians to anticipate those cases in which problems might arise so that essential attention can be paid to them.

Keywords: Cancellation, Surgery

INTRODUCTION

Unanticipated cancellation of scheduled elective operations decreases theatre efficiency, wastes theatre time and resources, adds to hospital expenses and is inconveniencing to the patients, their families and the medical teams.¹⁻³ It also causes patient dissatisfaction and decreased staff morale. Case cancellation results in wasted investigations and cross matching, leads to delay in patient care and can potentially affect the clinical outcome.⁴ The rate of surgical cancellation is one of the most important quality indicators of operation theatre facilities. The reasons for cancellations can be patient related, workup related, surgeon related or administrative. By knowing the reasons, appropriate steps can be implemented to reduce the rate of cancellations to a minimum.⁵

MATERIALS AND METHODS

This was a retrospective study done at Teerthanker Mahaveer Medical College and Research Centre, India.

Scheduled elective general surgical procedures were reviewed from theatre records from June 2009 to May 2010. Procedures that did not require an anaesthetist and those cancelled from the ward were excluded from the study. The patients were posted for surgery only after they had obtained preanaesthetic checkup (PAC) clearance. The operating schedule of the concerned units in the Department of General Surgery is prepared by the surgeons and sent to the OR by 15.00 Hours on each working day. Operative cancellations were defined as those patients that were scheduled in the operative list, were shifted to the OR but did not have the planned surgery on the intended date.

RESULTS

A total of 3618 surgeries were scheduled during the study period. Cancellations occurred in 246 (6.8%) cases. The reasons for cancellation were grouped into patient related, surgeon related, work-up related and administrative related (Table 1). Out of the 246 cancellations, no detailed

Table 1: Reasons for cancellations

Categories	Cancellation reasons	No.
Surgeon	Time constraints	74
	No senior surgeon available	14
	Surgical team involved in a different emergency	07
	Change in surgical plan	06
	Wrong diagnosis/decision	05
	Subtotal	106 (44.1%)
Administrative	Shortage of autoclaved surgical equipments/linen	20
	Lack of OT staff	09
	Blood not arranged by attendants	19
	Surgical equipment failure	07
	Acute disruption of water/electric supply	08
	Subtotal	71 (29.5%)
Work up	Acute change in medical status	24
	Abnormal laboratory tests	10
	Medical workup incomplete	05
	Subtotal	39 (16.2%)
Patient related	Patient refused consent	09
	Patient did not turn up	07
	Pre-operative instructions not followed	08
	Subtotal	24 (10%)

reason could be found in the medical records of 6 patients. The most common category for cancellations was surgeon related 106 (44.1%), followed by administrative 71 (29.5%), workup related 39 (16.2%), patient related 24 (10%). Overall, the most common reason for on the day cancellations in our study was the lack of availability of theatre time, (or time constraints) which in turn was because of overrun of previous surgery and intentional overbooking of the OR list.

DISCUSSION

The cost effective use of surgical facilities necessitates efficient use of theatre time and personnel. Clearly, repeated delays and cancellations result in increased costs for hospitals and frustration and anxiety to the patients and their families. Although there is no consensus on the acceptable rate of case cancellation, when analyzing the efficiency of theatre facilities, less than 5% is generally recommended.⁶ In New South Wales, Australia, the benchmark for booked patient cancellations on the day of surgery was less than 2% and cancellation due to medical reasons was set at less than 1%.⁷

In our study most of the on day cancellations were due to potentially avoidable reasons. Lack of availability of OR time was the most common reason for cancellations in our study. We further observed that cancellation due to this reason was due to overrun of previous surgery and overbooking the schedule list. Studies have shown

that simple measures like decreasing the room turn over time, on-time start of the first case of the day, set-up of anaesthesia equipment and setting of case trolleys performed in parallel reduce the rate of case cancellations due to overrun of previous surgery.^{8,9}

Estimating the operating time is also a very important factor to be kept in mind while preparing the OR schedule list for the next working day. The time taken for a particular surgery depends on the skill of the operating surgeon. Less experienced and trainee surgeons take more than expected time. Sometimes, the total duration of surgery increases due to unanticipated surgical complication or technical problems in surgical equipments. A previous study showed that those who underestimated the time needed for operation by an average of 10 minutes had a cancellation rate of 11%, compared to 6% for those who overestimated the time needed.¹⁰ There was no record of the estimated time at scheduling the list and the actual time taken for that surgery in our study. A further study can be done to compare each surgeon's estimated surgery time at the time of scheduling the OR list against the actual time taken.

A study by Pandit JJ, Carrey A⁵ estimated that overbooking a list was common (50%) due to waiting list pressures and to avoid any perception that the surgical team was not hardworking. Overbooking can be minimized by taking surgeon, anaesthesia, patient and theatre facilities into account whenever preparing the schedule list.

Booking of theatre cases are usually done after consultation between juniors and seniors, but this did not happen in our study. 14 cases were cancelled due to non availability of senior surgeons. Most of the times this was due to a sudden leave on the OR day, important meetings which could not be ignored or other administrative commitments. A good and effective communication within the surgical team could have avoided these unnecessary cancellations.

Seven patients could not be operated because the surgical team was busy with emergencies elsewhere. Five patients were cancelled because of the wrong/misdiagnosis, all of which were made by junior doctors. We recommend that the problem of wrong/misdiagnosis can be addressed by simply discussing the surgical cases to a senior member of the surgical team at least once when the patient has obtained PAC clearance and before being scheduled in the OR list.

Cancellations on medical grounds were reported in 24 (10%) cases in our study. A good preoperative assessment and appropriate physician consultation

could have avoided some of these cancellations. In our study 15 patients had an acute change in pulmonary status (URTI/LRTI), 4 patients had newly diagnosed hypertension, 3 patients had fever on the morning of surgery and 2 patients had an acute onset chest pain which had to be investigated further. Improved communication between surgeons, physicians and auxiliary services may expedite preoperative patient evaluation. Dufek et al¹¹ recommended improving the timeliness response by consultant physicians, along with improvement of protocol for preoperative patient evaluation as a means of addressing these problems. Delays in our patients also occurred from inadequacies in organizing laboratory tests and failure to wait for and check the results.

Administrative related reasons accounted for 71 (29.5%) of all cancellations in our study, shortage of autoclaved surgical instruments/linen being the most common reason in this category. All administrative cancellations were due to poor communication and lack of coordination between different departments involved in the efficient functioning of the OR. These reasons can be avoided if proper administrative measures are taken. Further, surgical cancellations due to administrative reasons should be recorded as adverse events of the hospital.

Patient related reasons contributed to 24 (10%) cancellations in our study, patient refusing consent being the most common reason (n = 09) in this category. It is difficult to establish why patients decide against a procedure. Whatever the reasons, improved communication between the patient and operating team would foster a better relationship that may reduce this type of cancellation. Eight procedures were cancelled because the patient had eaten breakfast on the morning of surgery. Again, effective communication about the preoperative instructions between the patient and the surgical team minimize these embarrassing events.

The main limitation of this study was that it was retrospective, though reasons of cancellations were documented adequately in 240 (97.5%) cases. Appreciation of the reasons for cancellation on the day surgery can improve theatre utilization by permitting administrators and clinicians to anticipate those cases in which problems might arise so that essential attention can be paid to them.

This study has identified common and avoidable causes of cancellation of general surgical cases. We recommend the number of cancellations can be reduced and theatre utilization improved:

1. By establishing good and effective preoperative assessment protocols and clinics.
2. Improved communication with patients about the proposed surgery and the preoperative instructions to be followed.
3. Ensuring that all patients are seen by consultants before scheduling them in the list.
4. Avoiding overbooking of the list.
5. Difficult cases (anticipated long surgeries, patients with poor general condition or comorbidities or difficult airway) be discussed with the concerned anaesthetist one day prior to surgery.
6. Better coordination between the surgeon, anaesthetist and the OR staff.
7. Repeatedly reviewing and readdressing the reasons of cancellation.

CONCLUSION

On the day cancellations of elective general surgical cases was a significant problem at this hospital. Identifying and addressing the cause improves the efficiency of theatre facilities. Case cancellations can be reduced by improving preoperative assessment, proper scheduling of cases and better interdepartmental coordination.

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How Safe is Safe Ear?: A Hospital Based Study

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Abstract

Introduction: Chronic suppurative otitis media is one of the commonest ear cases encountered in our outpatient department on day to day basis. Around half of the cases visiting outpatient department are ear problem cases, out of which 52% cases are of ear discharge. Hence this study was undertaken to know the various pathology encountered in chronic suppurative otitis media-tubotympanic type active so called safe ear type and to ensure whether safe ear discharge is really safe or not.

Materials and Methods: This study has been conducted in the Department of ENT, JSS Medical College and Hospital, Mysore, Karnataka, India. Study group includes 100 cases of chronic suppurative otitis media-tub tympanic type. Thorough history taking, otoscopic examination, audiometric evaluation, radiological investigation and blood investigations were done. Type of discharge, perforation, associated ear symptom, degree of deafness and otoscopic findings were recorded and patients were subjected to surgery (Cortical mastoidectomy/Tympanoplasty). Intra-operative finding on opening mastoid was taken into account, Otoscopic finding and findings at mastoid exploration compared and analyzed.

Results: Safe variety of Chronic Suppurative Otitis Media was common in age group between 21-30 yrs and was more in male population (57%) compared to females. Intraoperative finding showed around 66% cases with granulation in attic, aditus & antrum. Surprisingly 2% cases had cholesteatoma sac and histopathological finding of the specimens taken showed cholesteatoma in 8% of cases.

Conclusion: This study suggests that no perforation in Chronic Suppurative Otitis Media is a safe type of perforation. Hence the practice of calling disease as safe or unsafe depending on the site of the disease (tubotympanic or atticoantral) is questionable.

Keywords: Central perforation, Cholesteatoma, Chronic Suppurative Otitis Media, Mastoidectomy, Safe ear

INTRODUCTION

Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation.¹ World health organization defines CSOM as otorrhoea through a perforated tympanic membrane for atleast 2 weeks while others define "chronic" as symptoms persisting for more than 6 weeks.²

CSOM is classified into the safe (tubotympanic) and unsafe (atticoantral) variety depending on the likelihood of coexisting cholesteatoma.

Tubotympanic type which is considered as safe ear as it is less prone to intracranial complications and atticoantral

type, considered as unsafe ear or dangerous type as it is associated with cholesteatoma and frequently gives rise to intracranial complications.

The safe variety of CSOM i.e. CSOM without cholesteatoma can be further classified into active or inactive depending on whether there is infection or not.³

The present study was undertaken to know the various pathology encountered in tubotympanic type of CSOM i.e. "Safe ear" and to assess how safe is the safe ear?

MATERIALS AND METHODS

This study has been conducted over a period of 2 years in the Department of ENT JSS Medical College and

Hospital, Mysore, Karnataka, India. Total patients studied during the period were 100. Cases of tubotympanic type of CSOM, active ear (discharging ear) were considered. These cases were subjected to detailed otoscopic examination, audiometric and radiological examination, routine blood investigations, pus culture and sensitivity. Consent of patients was taken for conducting surgery. Cortical or simple mastoidectomy was carried out under general anaesthesia and intraoperative findings were noted. Specimens collected during the procedure was sent for histopathological examination.

Inclusion Criteria

- Tubotympanic type of CSOM, active discharging ear

Exclusion Criteria

- Atticoantral type of CSOM.
- Previously operated cases.
- Dry ear (Tympanic plexus seen & middle ear mucosa normal).

RESULTS

The age of patients was ranging between 10 and 70 years with majority (36%) being between 21-30 years as revealed in Table 1. There was male pre- dominance making up of 57% of total patient population. Most of them had moderate amount of mucopurulent discharge. There was more laterality to right ear. Otoscopic finding is depicted in Table 2. These cases were associated with other otological symptoms such as earache in 43% of the cases, giddiness and tinnitus in 18% of the cases and 39% of the cases showed deafness. Audiometric evaluation showed moderate degree of conductive hearing loss in most of the cases as shown in Table 3.

A detailed account of Intraoperative findings is mentioned in Figure 1. Surprisingly, 2% cases had cholesteatoma sac. Histopathological analysis of the specimens taken, showed cholesteatoma in 8% of cases and Tuberculous granuloma in 2% of the cases as shown in Figure 2. Figures 3 and 4 shows microscopic picture of cholesteatoma sac and tuberculous granuloma respectively.

DISCUSSION

Chronic suppurative otitis media is a disease of young adults and about 36% of the patients were between the ages of 21-30 years, which is comparable to the study done by group of workers on 50 cases of tubotympanic type of CSOM (4). The ratio of male to female patients was

1.33:1, showing male predominance; similar findings have been reported by several other authors.⁵⁻⁷

Otological examination showed 28 small central perforations whereas large central and subtotal perforations were 36 each.

Among the pattern of hearing loss, this series showed that 84% patients had conductive type of hearing loss, 12% had mixed type. Conductive type of hearing loss was the most common type and this was consistent with other study.⁸

Intraoperative finding showed around 66% cases with granulation in attic, aditus & antrum. Surprisingly 2% cases had cholesteatoma sac and histopathological finding of the specimens taken showed cholesteatoma in 8% of cases.

Table 1: Age distribution

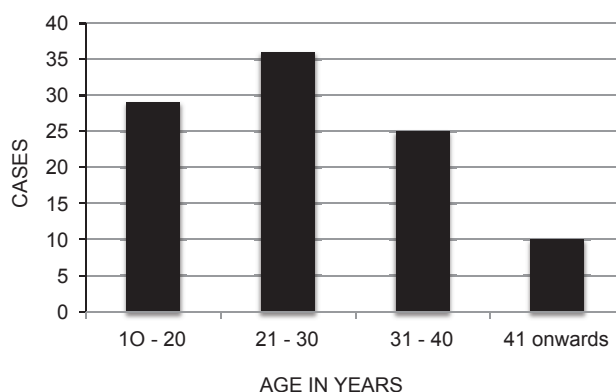


Table 2: Otoscopic findings

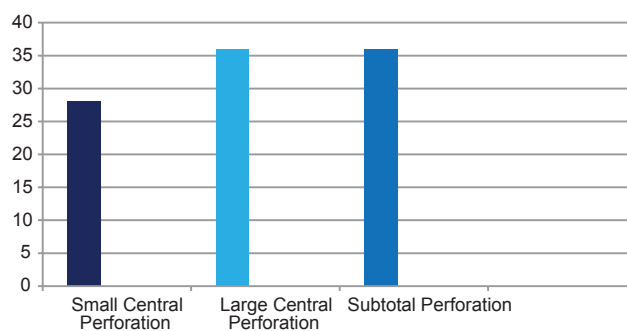


Table 3 : Audiometric evaluation

Conductive			Mixed	
Minimal	Mild	Moderate	Severe	Profound
25	29	30	7	8

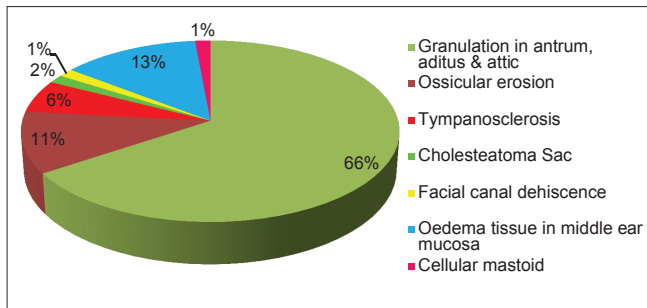


Figure 1: Intraoperative findings

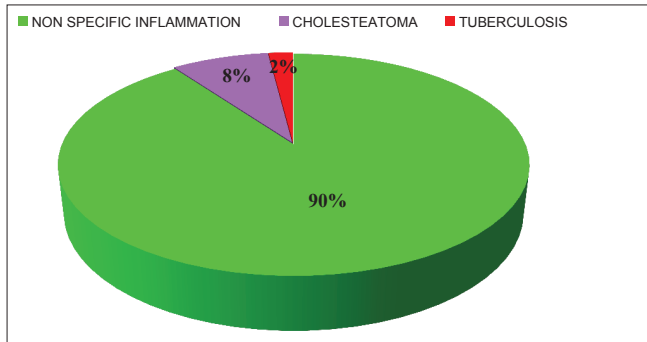


Figure 2: Histopathological findings

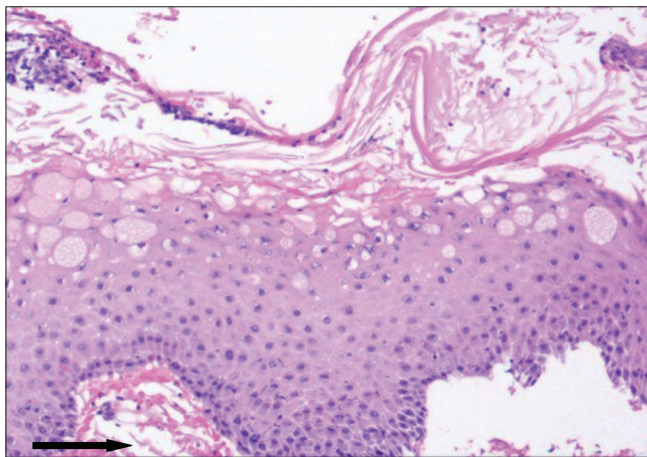


Figure 3: Picture showing cholesteatoma sac

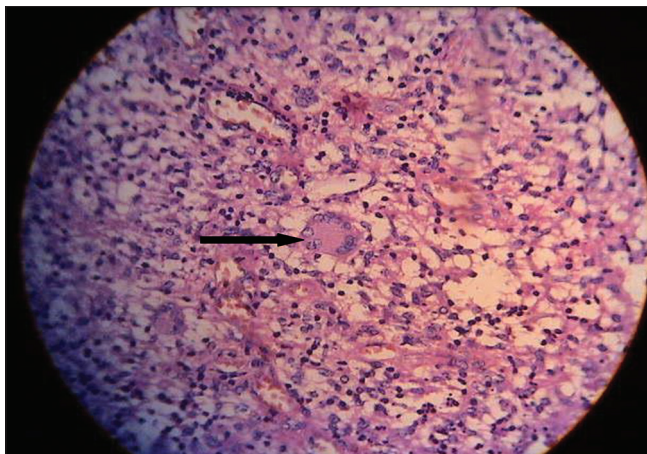


Figure 4: Picture showing tuberculous granuloma

In a study done to know the prevalence of cholesteatoma in chronic suppurative otitis media with central perforation, it was shown that although cholesteatoma is commonly found in CSOM with attic and marginal perforations, it is also found in case of central perforations. Although the involvement is rare, it was found in 3.4% of the study sample.⁹

In a Japanese study, 28 of 2948 ears with central perforation of the Tympanic membrane had cholesteatoma. Author was of the opinion that although a central perforation of the tympanic membrane is the typical finding of chronic otitis media without cholesteatoma, a keratinizing squamous epithelium on the tympanic side of the Tympanic membrane or in the tympanic cavity is occasionally found during surgery, although rarely.¹⁰

This study shows that although cholesteatoma is commonly found in CSOM with attic and marginal perforations, it is also found in tubotympanic type. Hence the study further affirms the suggestions of Rout MR et al.⁹, to call CSOM as safe type of CSOM when there is no associated cholesteatoma and unsafe type when it is associated with cholesteatoma.

CONCLUSION

The results of this study, makes one ponder whether labeling a disease safe or unsafe merely on the site of disease is right? The question to contemplate is whether safe (tubotympanic) type of CSOM is really safe as there was incidence of cholesteatoma intraoperatively in 2% cases and histopathologically in 8% cases in the present study. We conclude that in all Tubotympanic (discharging) cases of CSOM it is advisable to open the mastoid antrum and to do complete eradication of disease. This ensures prevention of further complication and helps to provide a safe ear and better hearing.

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Comparision of Posterior and Anterior Approaches for Internal Jugular Venous Cannulation – A Prospective & Randomised Controlled Study

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Abstract

Introduction: Of the numerous approaches for internal jugular venous cannulation, anterior approach is being widely practiced. But the major complications of this approach are carotid artery puncture and hematoma. With posterior approach, there is lesser incidence of arterial puncture and hematoma.

Materials and Methods: This study was conducted over a period of 9 months. The aim of this study is to compare posterior and anterior approaches for internal jugular vein cannulation in terms of number of attempts, duration of cannulation, ease of insertion and complications of approach by each route. 50 patients were considered for the study and they were randomly allocated into two groups to be cannulated with either anterior approach (Group A; n = 25) or posterior approach (Group B; n = 25). Demographic data was comparable in both groups.

Results: The number of attempts, duration of cannulation, incidence of arterial puncture, incidence of arterial puncture and hematoma are less with posterior approach. Ease of threading and chance of catheter displacement were comparable among both groups.

Conclusion: The posterior approach is better than anterior approach for internal jugular vein cannulation, as it improves the success rate, permits easy threading of catheter, reduces the access time and duration of cannulation. It reduces complications like arterial puncture, hematoma, pneumothorax, catheter displacement and thrombophlebitis.

Keywords: Anterior approach, Internal jugular venous cannulation, Posterior approach

INTRODUCTION

Central venous cannulation is an essential skill for critical care physicians. The choice of Central venous catheter insertion sites will depend on the indications, relative contraindications, risk of complications, patient factors predicting difficult cannulation, and the clinical conditions. The technique for Central venous catheter insertion is the same for single, double, and triple lumen catheters, as well as dialysis lines. Central venous catheterization is a vital intervention in critically ill patients and in major elective & emergency surgeries.

Common indications for Central Venous Cannulation

- Hemodynamic monitoring
- Administration of drugs likely to induce phlebitis

- Temporary cardiac pace maker
- Hemodialysis
- Lack of peripheral venous access

Relative contraindications to Central Venous Cannulation

- Inexperience, unsupervised operator
- Local infection
- Distorted local anatomy
- Coagulopathy
- Previous radiation therapy
- Suspected proximal vascular injury

Predictors of Difficult Cannulation

- Emergency Placement
- Obesity
- Coagulopathy

- Intubated
- Hypotensive/Hypovolemic
- Edematous patient and known previous difficult cannulation.

The proper choice of insertion is essential for success. Advantage of internal jugular vein cannulation relates to its consistent & predictable anatomic location,^{1,2} its valveless course to the superior vena cava, the possibility of repeated cannulation and low incidence of complication in experienced hands.

Of the numerous approaches for Internal Jugular Venous cannulation, the anterior approach is being practiced widely, since the identification of landmarks & palpation of carotid artery permits a beginner to learn the procedure easily. The major complications of this approach are carotid puncture & hematoma. Posterior approach is relatively less practiced due to myths regarding the complications.³⁻⁵

L. S. Kumar chowdhari *et al.*⁶ showed that access time and duration of cannulation were significantly less with posterior approach compared to anterior approach. Mohan chandrasekhar *et al.*⁷ have compared posterior approach with central approach for internal jugular venous cannulation and showed that posterior approach was superior to anterior approach with lesser incidence of complications.

V. P. Chandrasekharan *et al.*⁸ showed by a color Doppler study that anatomic variations of internal jugular vein in relation to carotid artery permits lesser chances of arterial puncture with posterior approach compared to anterior approach. It is also easier to perform in critically ill patients as the Trendelenburg position is not mandatory for this approach.

Our study compares the posterior and anterior approaches for internal jugular vein catheterization in terms of number of attempts, duration of cannulation, ease of insertion and complications of approach by each route.

MATERIALS & METHODS

After obtaining institutional ethical committee approval, 50 patients between 16-60 yrs of age of ASA (American Society of Anesthesiologists) Grade I/II/III pts requiring central venous catheterization including both critically ill & patients posted for elective & emergency surgeries were randomly selected for study. The study was undertaken over a period of 9 months between July 1st 2011 to March 31st 2012 in Government General Hospital, Kakinada.

These patients were randomly allocated into two groups of 25 patients each.

- Group A: Patients were cannulated by Anterior approach.
- Group P: Patients were cannulated by Posterior approach.

Inclusion Criteria

American Society of Anesthesiologists Grades I, II and III, both males and females, adult patients aged 16 to 60 years with scheduled elective and emergency surgeries and critically ill patients in intensive care.

Exclusion Criteria

Patients not fulfilling inclusion criteria, lack of patient consent, SVC syndrome, infection at the site of cannulation, coagulopathy, presence of carotid disease, contra lateral diaphragmatic dysfunction, thyromegaly, prior neck surgery, recent cannulation of Internal Jugular Vein.

PROCEDURE

The patient is placed in supine position with 20 degree head down position.⁴ Patient has been connected to monitoring devices like Pulse oximeter, ECG and Non Invasive Blood Pressure Monitor. The head was turned to opposite side & a support was placed under the shoulders to accentuate the landmarks. Under sterile aseptic precautions the following landmarks were identified: medial & lateral heads of sternocleidomastoid, clavicle, carotid artery pulsations, ipsilateral nipple, external jugular vein and suprasternal notch.^{1,2}

Anterior Approach

The triangle formed by the two heads of sternocleidomastoid muscle and clavicle should be identified.³ The carotid artery at the medial end of this triangle was palpated. Near the apex of the triangle, a skin wheal was raised with 1 ml of 2% lignocaine. Skin puncture was made at 30 degree to the skin with needle. The direction of the needle was towards ipsilateral nipple. With constant aspiration, the needle was slowly advanced until two tissue pops were felt at the prevertebral fascia and the vein wall. The position in the vein was confirmed by aspiration of dark blood. The vein was cannulated by modified Seldinger's technique. The hub of the cannula was anchored with sutures.

Posterior Approach

The point where the external jugular vein crosses the posterolateral border of sternocleidomastoid muscle is the entry point.⁴ A skin wheal was raised at this point with 1 ml of 2% Lignocaine. The body of the muscle was lifted and the needle was then advanced at an angle of 30 degree to the skin, directed towards the suprasternal notch. The rest of the procedure is similar to anterior approach.

Parameters Observed

Parameters observed during the procedure are number of attempts to identify the vein, time taken for identification of vein, time taken for cannulation (This was recorded as the time for skin puncture by the needle to complete threading of the catheter), ease of threading, arterial puncture and hematoma formation.

The parameters which were observed after the procedure are pneumothorax, hemothorax, catheter displacement and thrombophlebitis.

Statistical Analysis

A sample size of 25 per group was decided during the pilot study. Randomization of subjects to the two groups was done by using sealed envelopes. Data was expressed as mean \pm Standard Deviation. Quantitative analysis was compared with independent sample student's t-test. P value < 0.05 was taken as statistically significant. P value < 0.0001 was taken as highly statistically significant.

RESULTS

Both groups were comparable in terms of demographic variables like age, gender and body mass index, as shown in Table 1.

When compared to anterior approach, number of attempts required to successfully cannulate are less with posterior approach. 80% of the people were cannulated successfully in the first attempt by posterior approach compared to only 52% of the people by anterior approach, as shown in Table 2.

Time required to identify the vein was significantly less with posterior approach with a mean value of 0.18 min, compared to 1.06 min with anterior approach, which is highly significant statistically. Also the duration of cannulation was significantly lower with posterior approach with a mean value of 2.43 min, compared to a mean value of 3.64 min with anterior approach. The ease of threading was relatively better with posterior approach, although it is not significant statistically, as shown in Table 3.

The incidence of arterial puncture and hematoma are significantly lower with posterior approach, compared to anterior approach. We have encountered three cases of arterial puncture with anterior approach, compared to only one case with posterior approach, as shown in Table 3.

The incidence of other complications was also lower with posterior approach. We have encountered two cases of pneumothorax with anterior approach, where as none of the cases cannulated with posterior approach had

pneumothorax or hemothorax. Also the incidence of catheter displacement and thrombophlebitis are lower with posterior approach although not statistically significant, as shown in Table 4.

DISCUSSION

This study compares the widely popular technique of anterior approach of cannulation of the internal jugular vein to the posterior approach. In posterior approach the point of entry is higher up in the neck⁴ and thus providing a longer length of vein for cannulation and avoiding the dangers of hemothorax, pneumothorax and arterial puncture.

The aim of the study was comparison of anterior and posterior approaches for internal jugular cannulation in patients undergoing elective & emergency surgeries and in the critically ill. All patients were comparable in terms of age, gender and body mass index. The number of attempts to identify the vein was lesser with posterior approach.

Table 1: Demographic data

Parameter	Group A (n-25)	Group P (n-25)	P value
Age	43.87 \pm 18.97	44.86 \pm 16.54	0.84 (NS)
Gender (M/F)	17/8	16/9	-
Body mass index	24.96 \pm 4.82	23.87 \pm 4.96	0.43 (NS)

Table 2: Number of attempts in both the groups

No of attempts	Group A (n-25)	Group P (n-25)
1	13 (52%)	20 (80%)
2	6 (24%)	4 (16%)
3	3 (12%)	1 (04%)
4	3 (12%)	-

Table 3: Results in both the groups

Parameter	Group A (n-25)	Group P (n-25)	P value
Time to identify the vein (min)	1.06 \pm 0.56	0.18 \pm 0.12	<0.0001
Duration of cannulation	3.64 \pm 0.58	2.43 \pm 0.32	<0.0001
Ease of threading	18 (yes) 7 (no)	20 (yes) 05 (no)	-
Arterial puncture	3/25	1/25	-
Hematoma	1	0	-

Table 4: Complications in both the groups

Parameter	Group A (n-25)	Group P (n-25)
Pneumothorax	2	Nil
Hemothorax	Nil	Nil
Catheter displacement	3	2
Thrombophlebitis	3	2

52% of pts were cannulated by first attempt by anterior approach while it was 80% by posterior approach which was highly significant statistically.

The access time & duration of cannulation was lesser with the posterior approach. It took around 1.06 mins to identify vein by anterior approach whereas it is only 0.18 mins on an average to identify vein by posterior approach which is highly significant statistically. Also the duration of cannulation is much shorter by posterior approach (2.43 min) compared to anterior approach (3.64 mins) which is significant statistically.

The posterior approach permits easier threading than anterior approach even though it is not significant statistically. Cannulation by posterior approach reduced the rate of arterial puncture and hematoma significantly. We have encountered 1 case of arterial puncture in posterior approach compared to 3 cases with anterior approach which is highly significant statistically. We found no cases of pneumothorax & hemothorax by posterior approach whereas 2 cases cannulated by anterior approach had pneumothorax.

Wisheart et al.⁵ reported a case of injury to the ascending cervical artery by the posterior approach. We have not encountered any case of cervical artery injury in our study.

In the posterior approach there was a low rate of catheter displacement, although it was not significant statistically. Other complications like Thrombophlebitis were less in posterior approach. The posterior approach improves the success rate, permits easier access and threading in obese patients. The posterior approach provides a safe alternative route in patients like short necked, obese, critically ill, patients on tracheostomy, and pathology in lower part of the neck.

Lamkinsi et al.⁹ have shown that posterior approach in internal jugular venous cannulation is more efficient than and as safe as the anterior approach.

Brown et al.¹⁰ have reported a case of chronic hematoma following percutaneous internal jugular venous cannulation which required surgical removal two months later. In our study we have encountered a case of hematoma with anterior approach but the swelling spontaneously subsided within 2 hrs after applying continuous pressure.

Arnold S et al.¹¹ described bilateral pneumothorax and subcutaneous emphysema as a complication of internal jugular vein puncture.

Cook FL et al.¹² described tension pneumothorax following internal jugular venous cannulation under General anaesthesia. But we have not encountered these complications in both of these approaches.

CONCLUSION

In conclusion, the posterior approach is better than anterior approach for internal jugular vein cannulation as it improves the success rate, permits easy threading of catheter, reduces the access time and duration of cannulation. It reduces complications like arterial puncture, hematoma, pneumothorax, catheter displacement and Thrombophlebitis. The posterior approach permits easier access, improves the success rate and reduces the complications in obese patients.

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Nutritional Status of Rural School-Going Children (6-12 Years) of Mandya District, Karnataka

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Abstract

Introduction: Nutritional deficiencies are common in children of developing countries like India although the prevalence is reduced due to various steps taken by the Government and the health care personnel for the prevention and treatment of the same. This study is to understand the common nutritional disorders in rural school going children so that further measures can be taken for the improvement of their health status.

Objective: To assess the nutritional status of rural school-going children (6-12 years) of Mandya district, Karnataka.

Materials and methods: We conducted an observational cross sectional study of children of age group 6-12 years, studying in BGS Model Public School, BG Nagara, Nagamangala Taluk, Mandya district, Karnataka. The children were assessed for nutritional status by clinical examination as well as anthropometric assessment and were compared with the standard national data.

Results: A total of 484 children were studied. The overall prevalence of underweight was 30.3% (147) and stunting was 27.9% (135). Pallor was noted in 123 (25.4%). Hair changes were seen in 19 (3.9%). Eye changes noted in the form of conjunctival xerosis in 100 (20.7%) and bitot's spots in 10 (2.1%). Teeth changes were noted in the form of dental caries in 137 (28.3%) and enamel mottling in 19 (3.9%). Skeletal changes were noted in 7 (1.4%) children. Flat nails or koilonychia were noted in 57 (11.8%).

Conclusion: Nutritional status of the school children in Mandya district was found to be low especially with respect to the high prevalence of anemia, micronutrient deficiencies and personal hygiene. Emphasis should be given towards nutrition education, personal hygiene education, health education apart from the regular educational activities in the community.

Keywords: Health education, Nutritional status, School children

INTRODUCTION

There is a growing concern over the child health all over the world with rapid economic growth and social changes. Major determinant of health status in an adult is their nutritional status in childhood. Protein Energy Malnutrition is the most important nutritional problem globally which is more severe in third world countries affecting children of under five age category. 20-80% of primary school children are suffering from nutritional deprivation. Assessment of nutritional status of this segment of population is essential for improving the overall health. Recent study by NFHS-3 has not reported on nutritional status of school age children.¹

The term malnutrition refers to both under-nutrition and over-nutrition. Good nutrition provides stronger immune

system, better health and productivity. Various forms of malnutrition including both macro and micronutrient deficiencies affect a large segment of population in India.²

Study done by Nigudgi SR et al. from Gulbarga, Karnataka, among 935 students in higher primary schools of Gulbarga city showed that, 50.05% children were below average weight for age, 22.35% children had specific deficiency diseases in which bitot's spot in 48.80% children and anemia in 10.05%.³ Hasan et al. from Bangalore, conducted nutritional assessment study among 500 children in three Government Urdu higher primary schools of Azad Nagar and its surrounding area. The overall prevalence of malnutrition in the school children was found to be 52% (260). The prevalence of malnutrition among boys was 53.85% (161) and among girls was 49.25% (99).

Stunting was seen in 41.47% (124) boys and 38.81% (78) girls.⁴

Similar studies were also performed in various parts of India. Study done by Navaneethan et al. among 810 school going students of Vellore, Tamilnadu belonging to age group 11-18 years, showed that 83% students were underweight for their age.⁵ 150 school going children from Allahabad belonging to age group 7-10 years were studied by Ruchika et al., and found that mean height and weight in these children were significantly less than the National standards. 65.33% had hemoglobin level below the normal values, indicating anemia, out of which 53.33% were mild anemic and 12% were moderately anemic.⁶ Vandana et al. studied 200 rural school going children of 7-9 years in Hisar district, Haryana, found that 55.5% were underweight and 54.11% of the children were stunted.

School health services play an important role in the development of every child by providing comprehensive care of the health and wellbeing of children during the school years. As health and education are intimately related, the advantages of health education can be attained best in the school. Health education should give more emphasis to prevent health problems rather than providing cure.³

AIMS AND OBJECTIVES

Children of the age group 6-12 years accounts to about 1/5th of the total Indian population. During the adolescent growth spurt body requires lot of nutrients which should be stored in the body during childhood and if body stores are deficient it can result in adverse health consequences like growth retardation, scholastic backwardness and reduced work capacity. There is a relative scarcity of available literature on the information regarding nutritional status of school going children particularly from rural areas. Keeping this in view, the objective of present study was to assess the nutritional status of rural school-going children of Mandya district, Karnataka.

MATERIALS AND METHODS

This was an observational cross sectional study of children studying in BGS Model Public School which comes under the management of Sri Adichunchanagiri Shikshana Trust, located in BG Nagara, Nagamangala Taluk, Mandya district, Karnataka.

Method of Collection of Data

After obtaining authorized consent from the management, the school was visited and the data was collected using readymade proforma. All children between 6-12 years

of age as determined using school records were included in the study. The data was collected by interviewing and examining the children with the help of class teacher. The children were assessed for nutritional status by clinical examination and by measuring height (cm), weight (kg) which was compared with the NCHS (National Center for Health Statistics) Standards and the standards given by ICMR (Indian Council of Medical Research). Weight was measured using a floor type weighing scale with due respect to the standardization of the equipment and procedure. The measurements are taken to the nearest 0.5 Kg. Height was measured using a measuring tape applied to the wall. The measurements are taken with children barefoot with their back of heels, buttocks and head touching the wall. Readings are taken to the nearest 0.5 cm. The important signs looked for during clinical examination are Pallor, Hair changes (sparse hair/depigmentation of hair), Eye changes (conjunctival xerosis, bitot's spots, corneal xerosis, corneal ulceration, keratomalacia) Cheilosis/angular stomatitis, Teeth changes (enamel mottling, caries, delayed eruption), Skeletal changes, Goiter, Skin changes (dry skin, flaky paint dermatosis, crazy pavement dermatosis) and Koilonychia.

RESULTS & DISCUSSION

A total of 484 children were studied belonging to the age group 6 to 12 years (Table 1). Out of the 484 students, 254 (52.5%) were boys and 230 (47.5%) were girls.

Among the 484 children, 67 (13.8%) were belonging to 6-7 years age group, 74 (15.3%) were belonging to 7-8 years age group, 72 (14.9%) were belonging to 8-9 years, 90 (18.6%) were belonging to 9-10 years, 93 (19.2%) were belonging to 10-11 years age group and 88 (18.2%) were belonging to 11-12 years age group (Table 2).

Prevalence of Underweight

The overall prevalence of underweight in the studied school children was 30.3% (147) (Table 3). The prevalence of underweight in boys was 32.3% (82) and in the girls, it was 28.3% (65). The prevalence of underweight was more among boys compared to girls (32.3% vs 28.3%). Among the boys underweight was seen more commonly in the age group 6-7 years (44.4%) and among girls in 11-12 year age group (34.1%).

Prevalence of Stunting

The overall prevalence of stunting in the under study school children was 27.9% (135) (Table 4). The prevalence of stunting in boys was 29.1% (74) while in girls it was 26.5% (61). The prevalence of stunting was more in boys as compared to girls (29.1% vs 26.5%). Among both boys and girls, stunting was noted more commonly in the age group 11-12 years with 34% in boys and 29.2% in girls.

In the present survey we observed a prevalence of under nutrition (30.3% and 27.9% for underweight and stunting respectively). It was found to be less when compared to results of study done by Hasan et al. from Bangalore among 5-14 year old children (58.2% and 40.4% for underweight and stunting respectively).⁴ Ruchika et al. from Allahabad reported a prevalence of 25% underweight and 17.3% stunting in children of 7-10 years age group.⁶ Anjum et al. in a study from Kashmir among 5-14 year old children had reported only 11.1% and 9.25% for underweight and stunting respectively.¹ G K Mendhi et al. from Assam reported a prevalence of 47.4% stunting and 51.7% underweight in 6-8 year old children.⁷ Bandopadhyay et al. from Navinagar Mumbai reported prevalence for stunting 16.8% and underweight 42.3%.⁸ Mitra et al. from Chatisgarh reported prevalence of underweight 90.0% and stunting 47.5%.⁹ Similarly Chowdhary et al. from Puriliya

West Bengal also reported figures of underweight 33.7% and stunting 17.0%.¹⁰

Prevalence of Nutritional Deficiencies

Iron deficiency anemia is the most common nutritional deficiency which affects health, education, economy, and productivity of the entire nation (Table 5). Appropriate and timely intervention can prevent a large portion of cases.

In our study, out of 484, pallor was noted in 123 (25.4%) children who included 59 boys and 64 girls and was more common in the age group 9-10 years (42%). Flat nails or koilonychia were noted in 57 (11.8%) children who included 25 boys and 32 girls. It was more seen in age group 6-7 years.

Pravin et al. in a study among 1808 school going children of 49 villages of Dharwad and Haliyal taluks reported an anemia prevalence of 25.5%.¹¹ Muthayya S et al. in a study among school age children in Bangalore reported an overall low prevalence of anemia of 13.6%. Anemia prevalence was lower in boys than girls (12.0%; n = 1037 vs 15.3%; n = 993 respectively, $P < 0.05$). There was no significant difference in anemia prevalence between children in urban and rural locations (14.6 and 12.3%, respectively). They also concluded that the current low anemia prevalence in Bangalore could be due to the impact of school-based intervention programs that have been in place since 2003.¹² Verma M et al. reported a 51.5% prevalence of anemia among urban school children of Punjab.¹³

Hair changes in the form of sparse hair or depigmented or lusterless hair were seen in 19 (3.9%) who included 12 boys and 7 girls and was more in the age group 9-10 years (6.7%). Prabhakar et al. assessed the nutritional status of Jenukuruba tribal children in Mysore District, Karnataka and found that majority of the children had lack of luster (94.1%), sparseness (94.1%) and straightness (83%) in hair.¹⁴

Vitamin A deficiency disorder spectrum has the unique distinction of being one of the most important causes of 'Preventable blindness' the world over, and xerophthalmia still remains a problem in the developing countries. In our study, eye changes noted in the form of conjunctival xerosis in 100 (20.7%) who included 58 boys and 42 girls and bitot's spots in 10 (2.1%) who included 7 boys and 3 girls. Conjunctival xerosis was seen more commonly in the age group 8-9 years (36.1%) and bitots spots in the age group 9-10 years (4.4%). Prasanna et al. studied the prevalence of ocular morbidity among school going children (6-15 years) in Kolar district of Karnataka found that Vitamin A deficiency was the commonest ocular morbidity (33.8%) which manifested as bitot spots and

Table 1: Sex wise distribution of children studied

Sex	Number of children	Percentage
Boys	254	52.5
Girls	230	47.5
Total	484	100

Table 2: Age wise distribution of children studied

Age group (years)	Number of children (%)	Boys (%)	Girls (%)
6-7	67 (13.8)	36 (53.7)	31 (46.3)
7-8	74 (15.3)	40 (54)	34 (46)
8-9	72 (14.9)	40 (55.5)	32 (44.5)
9-10	90 (18.6)	44 (48.9)	46 (51.1)
10-11	93 (19.2)	47 (50.5)	46 (49.5)
11-12	88 (18.2)	47 (53.4)	41 (46.6)
Total (%)	484 (100)	254 (52.5)	230 (47.5)

Table 3: Prevalence of underweight

Age group	Boys (%)	Girls (%)
6-7	16 (44.4)	10 (32.2)
7-8	14 (35)	9 (26.4)
8-9	10 (25)	9 (28.1)
9-10	14 (31.8)	10 (21.7)
10-11	13 (27.6)	13 (28.2)
11-12	15 (31.9)	14 (34.1)
Total (%)	82 (32.3)	65 (28.3)

Table 4: Prevalence of stunting

Age group	Boys (%)	Girls (%)
6-7	10 (27.8)	8 (25.8)
7-8	11 (27.5)	8 (23.5)
8-9	11 (27.5)	9 (28.1)
9-10	12 (27.3)	11 (23.9)
10-11	15 (31.9)	13 (28.2)
11-12	16 (34)	12 (29.2)
Total (%)	74 (29.1)	61 (26.5)

Table 5: Prevalence of nutritional deficiencies

Age group	Pallor (%)	Hair changes (%)	Conjunctival xerosis (%)	Bitots spots (%)	Dental caries (%)	Enamel mottling (%)	Skeletal changes (%)	Skin changes (%)	Koilonychia (%)
6-7	21 (31.3)	3 (4.5)	14 (20.9)	2 (2.9)	31 (46.2)	4 (5.9)	3 (4.5)	4 (5.9)	19 (28.3)
7-8	15 (20.2)	2 (2.7)	19 (25.6)	1 (1.3)	20 (27)	2 (2.7)	2 (2.7)	7 (9.4)	13 (17.5)
8-9	14 (19.4)	3 (4.2)	26 (36.1)	2 (2.7)	20 (27.7)	1 (1.4)	2 (2.8)	3 (4.1)	9 (12.5)
9-10	38 (42)	6 (6.7)	28 (31.1)	4 (4.4)	34 (37.7)	8 (8.9)	0 (0)	8 (8.9)	6 (6.7)
10-11	20 (21.5)	2 (2.1)	8 (8.6)	0 (0)	23 (24.7)	3 (3.2)	0 (0)	4 (4.3)	9 (9.7)
11-12	15 (17)	3 (3.4)	5 (5.7)	1 (1.1)	9 (10.2)	1 (1.1)	0 (0)	8 (9)	1 (1.1)
Total (%)	123 (25.4)	19 (3.9)	100 (20.7)	10 (2.1)	137 (28.3)	19 (3.9)	7 (1.4)	34 (7)	57 (11.8)

conjunctival xerosis.¹⁵ In a study at rural north Maharashtra by Jayant D and Malathi, 25.58% Vitamin A deficiency was reported.¹⁶

The prevalence pattern of dental caries varies with age, sex, socio economic status, race, geographical location, food habits and oral hygiene practices. In our study teeth changes were noted in the form of dental caries in 137 (28.3%) who included 71 boys and 66 girls and enamel mottling in 19 (3.9%) who included 8 boys and 11 girls. Dental caries was most commonly seen in the age group 6-7 years (46.2%) and enamel mottling in the age group 9-10 years (8.9%). Saravanan S et al. from Pondicherry reported a prevalence of dental caries of 44.4% in 5 years age group and 22.3% in 12 years age group.¹⁷

Skeletal changes were noted in 7 (1.4%) children who included 4 boys and 3 girls and seen more in 6-7 years age group. There is a high prevalence of subclinical and biochemical hypovitaminosis D in apparently healthy school children in India. Raman et studied the vitamin D and bone mineral density status of healthy school children of north India and Clinical evidence of vitamin D deficiency was noted in 10.8% of the children.¹⁸

Only a healthy body can harbor a healthy mind. Malnutrition accounts for the majority among the various problems faced by the school going children. It should be efficiently and timely assessed and corrective measures should be employed accordingly. Despite the fact that several national nutrition programmes are in operation, especially for the benefit of children, the prevalence of micronutrient deficiencies, particularly among rural children, continues to be of public health concern. There are certain limitations for this study. Nutritional status of the children depends on the education, occupation and socioeconomic status of the parents which was not assessed in this study as parental interview is required. Detailed diet history of the children from the time of birth also helps in establishing the cause for particular nutrient deficiencies as well as laboratory testing for the confirmation of certain nutritional deficiencies were not done.

CONCLUSION

The present study reveals that, the rural school going children of Mandya district are suffering from different grades of malnutrition. Mothers of these children should be educated about the importance of balanced diet. Consumption of foods like cereals, pulses, green leafy vegetables, roots and tubers, sugar and jaggery, fats and oil, milk and milk products, fruits etc., should be promoted. Government should introduce awareness programs through community participation, involvement of NGOs and other sectors regarding affordable but nutritious foods.

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Prevalence of Traumatic Dental Injuries among School Going Children in Farukhnagar, District Gurgaon

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Abstract

Background: Dental trauma is a significant problem in children which requires immediate attention. Dental injuries may occur throughout life, but Traumatic Dental Injuries (TDI) is a very significant problem among children.

Objective: To assess the prevalence and role of risk factors in traumatic dental injuries (TDI) on 12 and 15 year old school going children of Farukhnagar (Gurgaon), Haryana.

Methods: A cross-sectional survey was conducted among 12 and 15 year old school going children. The schools were selected by random sampling from Farukhnagar block. The demographic detail was recorded on a structured questionnaire. The data regarding the traumatic injuries was recorded using Elli's classification of traumatic dental injuries (TDI)

Results: Prevalence of TDI was found to be 12.8% in which maxillary central incisors were the most common tooth affected due to trauma, surprisingly majority of TDIs were untreated.

Conclusion: There is a substantial amount of untreated TDI so it is crucial to generate and implement health promotion strategies and facilitate dental care in schools

Keywords: Permanent Teeth, School Children, Trauma

INTRODUCTION

One of the greatest assets a person can have is a "smile" that shows beautiful, natural teeth. An untreated and unsightly fracture of an anterior tooth can affect the behavior of a child, his progress in school and can have more impact on their daily living.¹ Trauma to anterior teeth is undesirable and prevention of this is beneficial to the personality development of the child.

Dental injuries may occur throughout life, but Traumatic Dental Injuries (TDI) are a very significant problem among children. The main etiology being accidents like falls, fights and during sports.² They are associated with biological, socio-economic, psychological and behavioural factors. The predisposing dental risk factors include increased incisal overjet, openbite, protrusion and lip incompetence.³

During the school age, children actively indulge in outdoor play, especially organized bodily contact play. Careless activities increase the possibility of injuries. Though these activities are markers of growth and development of the child, loss of balance and impaired movements are the result of traumatic injuries.⁴

The problem of fracture anterior teeth is a perplexing one to the parent, child and especially the dentist.¹ The behavior of child, as well as his progress in school and especially his psychological stability can be affected by an untreated and unsightly fracture of an anterior tooth.

Recent studies have shown that there is decrease in the incidence of dental care owing to the development and implementation of various programmes in the prevalence of dental caries. However, TDI are on the rise and are the

3rd largest cause for the mortality of teeth but the treatment of TDIs tends to be neglected.⁴ Though the majority of the studies on TDI are on permanent teeth in adolescents were conducted in Europe and Americas but there are few studies from Asia and Africa. There is evidence that the prevalence of TDI is prevalent in India and Haryana being the prosperous state encouraging sports and providing infrastructure and facilities to students more than any other state in India, hence the present study was carried out in Farukhnagar block, district Gurgaon to estimate the prevalence of traumatic injuries to the anterior teeth in government and private school children and to find out dental risk factors related to traumatic injuries to permanent anterior teeth in 12 and 15 years school going children of Haryana, India.

MATERIALS AND METHODS

A cross-sectional survey was carried out in six government and six private schools among 671 school children aged 12 and 15 years in Farukhnagar block, district Gurgaon, Haryana. The sample size determination was done by conducting pilot study and minimum sample size to satisfy the requirement was estimated to be 672 children with 20% allowable error. A multistage sampling technique was adopted to select the children from Farukhnagar block which formed one of the four blocks of Gurgaon district. It was selected on the basis of ease of accessibility. There are 48 government schools and 6 private schools in Farukhnagar block. 6 schools were randomly selected from government schools and all the private schools were included with a sampling by a probability proportional to the school size.

The school children of age 12 and 15 years formed the study population taking care of selecting almost equal number of boys and girls. Before examining the children, consent was obtained from the concerned authorities of the respective schools and ethical clearance was obtained from the ethical committee of S.G.T Dental College.

The children aged 12 and 15 with signed consent and in whom permanent anteriors had erupted were included in the study. Children with severe dental fluorosis graded using Dean's criteria for dental fluorosis, developmental anomalies of teeth or children undergoing orthodontic treatment or children in whom the permanent anterior teeth had not yet erupted were excluded. Also, the children in whom the permanent anteriors were lost due to caries or cause other than trauma or those having partial/complete anodontia involving permanent anteriors were not included in the study.

A close-ended questionnaire was prepared to collect data. Sociodemographic data included age and sex.

Nonclinical data collected included place of injury, cause of injury, sign and symptoms of injury and treatment undertaken due to injury. The oral examination was conducted by a single calibrated examiner using a Ellis's classification (Table 1) in a preformed proforma. The clinical examination was conducted with the use of a plane mouth mirror to assess the prevalence of traumatic dental injuries and a CPITN probe to measure dental risk factors like incisal overjet, overbite and lip competency. The examination was conducted in a well ventilated classroom under natural daylight. Type III clinical examination was performed. The school children were made to sit on a stool, the examiner would stand in front of them. Then the examination of traumatic dental injuries was recorded on maxillary and mandibular teeth.

The survey data were coded and results were analyzed using "Statistical Package of Social Sciences" (SPSS) 20 software. Data analysis included descriptive statistics (frequency distribution and cross tabulation). Chi-square test was employed to compare qualitative data and determine the statistical significance. The level of statistical significance was set at $p < 0.05$.

RESULTS

A total of 671 children aged 12 and 15 years were examined from government (363) and private (308) schools (Graph 1). The overall prevalence of TDI to the anterior teeth was found to be 12.81%. The observed prevalence of dental trauma was higher in boys (58.1%) (Graph 2) than in girls (41.86%). There was no statistical difference between traumatic dental injuries between government and private school children, nor with respect to age or sex (Tables 1 and 2). The permanent maxillary central incisors were the most common teeth affected due to trauma and accounted for approximately 93.75%, out of which, the permanent left maxillary central incisor accounted for 57.8% of the injuries followed by the permanent right maxillary central incisor with 35.93% (Graph 3). Enamel fracture (65%) was the most common type of TDI in both arches, followed by fractures involving both enamel and dentin (27%) and only (8%) involving pulp (Table 3, Table 4). The majority of TDIs occurred at home and at school during physical leisure activities such as playing sports and followed by teeth misuse like opening bottles with teeth. Regardless of the dental injuries, it was found that 88.37% of the subjects did not receive any dental evaluation or control of the problem (Table 5). No significant findings were found in relation to risk factors associated with traumatic dental injuries (Table 6).

RESULTS

Table 1: Demographic characteristics of study subjects found inflicted with dental injury on clinical examination

	Government	Private	P value*
Age group			
12yrs	18	18	0.194
15yrs	31	19	
Total	49	37	
Gender			
Male	26	24	0.174
Female	24	12	
Total	50	36	

*Chi square test was applied

Table 2: Comparison of prevalence rate between government and private school

	Traumatic dental injury	With no traumatic dental injury	Total	P value*
Type of school				
Government	47	313	363	0.649
Private	39	272	308	
Total	86	585	671	

Table 3: Frequency distribution of traumatic injuries according to affected teeth

Injured teeth	School		Total
	Government	Private	
13	0	0	0
12	2	2	4
11	24	22	46
21	26	20	74
22	2	0	2
23	0	0	0
33	0	0	0
32	0	0	0
31	0	0	0
41	0	0	0
42	2	0	2
43	0	0	0

Table 4: Distribution of TDI according to fracture

Type of elli's dental injury	N
Type I	62
Type II	26
Type III	08
Type IV	0
Type V	0
Type VI	0
Type VII	0
Type VIII	0
Type IX	0

Not Found

Table 5: Frequency distribution of 12 and 15 years old children with Traumatic Dental Injuries

Parameter assessed for dental injury	Government	Private	Total	P value
Time of injury				
Same day	0	0	0	0.036
4-7 days	0	3	3	
8 days- 3 weeks	1	0	1	
3 weeks- 3months	4	8	12	
3months- 1 year	3	0	3	
>1 year	39	28	67	
Total	47	39	86	
Place of injury				
Home	21	34	55	0.000
Street	4	0	4	
School	16	5	21	
Other places	6	0	6	
Total	47	39	86	
Cause of injury				
Sports	28	15	43	0.011
Teeth misuse	18	17	35	
Violence	1	0	1	
Accidents	0	7	7	
Total	47	39	86	
Symptoms/outcome of injury				
Pain	5	4	9	0.006
Swelling	2	7	9	
Sensitivity in the area	9	1	10	
Discoloration of tooth	3	0	3	
Nothing happened	28	27	55	
Total	47	39	86	
Whether any treatment was taken for injury				
Treatment taken	2	8	10	0.046
Not taken	45	31	76	
Total	47	39	86	
Time elapsed between injury and time of treatment				
Same day	2	2	4	0.049
After more than one day	0	4	4	
Total	2	6	8	
Type of treatment received				
Medication without any procedure	0	6	6	0.006
Some treatment procedure	2	0	2	
Total	2	6	8	
Outcome after treatment (mention after how much time)				
Residual problem felt/ persisted	0	2	2	0.107
No residual problem	0	4	4	
Total	0	6	6	

DISCUSSION

Traumatic dental injury is not a result of disease but a consequence of several factors that may include demographics or risk factors like overjet, overbite that will accumulate throughout life if not properly treated.

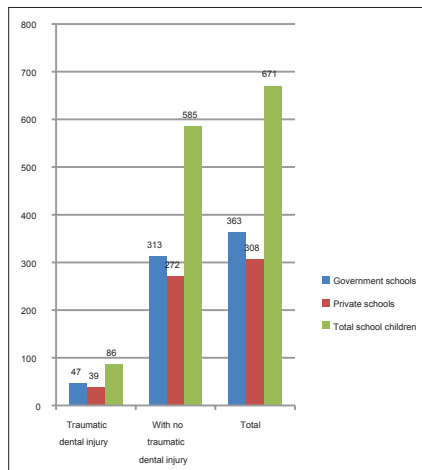
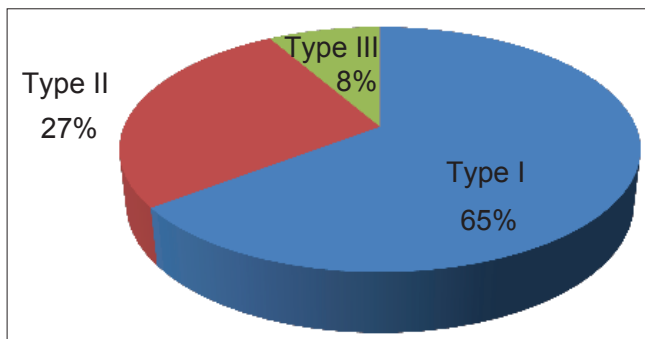
This cross-sectional survey identified the prevalence of traumatic dental injuries to the permanent anterior teeth in 12 and 15 year old school children of government and

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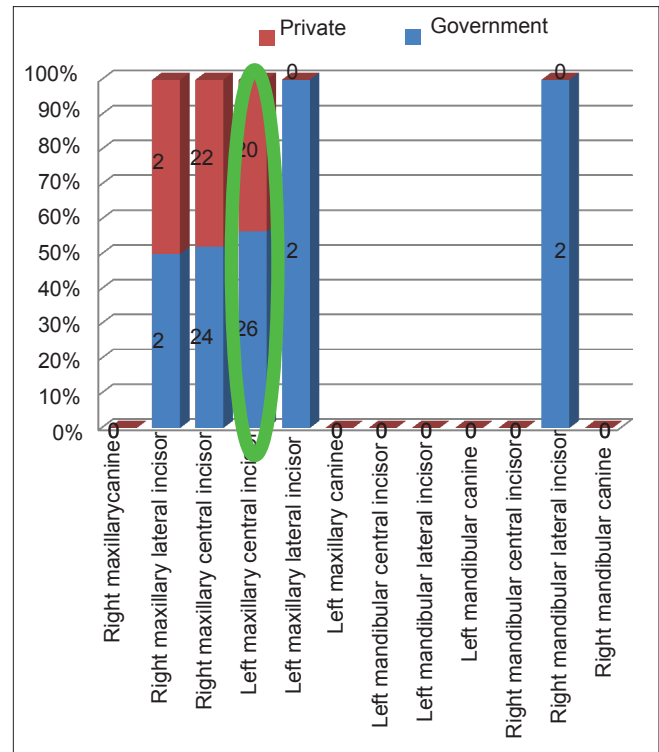
Table 6: Distribution of dental abnormalities among the children with dental injury on clinical examination

Type of dental abnormality	Government	Private	Total	P value
Over jet				
1-2mm	26	24	50	0.239
2-4mm	13	10	23	
>4mm	8	5	13	
Total	47	39	86	
Overbite				
No overbite	18	11	29	0.249
1-2mm	22	17	39	
2-4mm	6	5	11	
>4mm	1	6	7	
Total	47	39	86	
Lip				
Adequate	45	38	83	0.225
Inadequate	2	1	3	
Total	47	39	86	

*Chi square test with Yate's Correction was applied **Fisher's exact test was applied

**Graph 1: Prevalence of traumatic dental injuries among school going children****Graph 2: Frequency of type of trauma seen. Note: Elli's classification 4 to 8 was not observed in the study population**

private school as 12.8%. A similar observation was reported by Gupta K; Tandon S et al⁴ (2002) in South Kanara school children where a marginally higher prevalence of 13.8 % of TDI was observed, another study reported a

**Graph 3: Frequency of type of tooth affected**

percentage of 15.1% among 12 year school children of Davangree, South India by Ravishankar TL et al⁵ (2010), similarly Kumar A et al⁶ (2011) observed a prevalence of 14.4% among 12 to 15 year old school children in Ambala district, Haryana. Dua R et al⁷ observed a prevalence of 14.5% among 7 to 12 year old school children in Dera Bassi, another recent observation made by Patel MC et al⁸ (2012) found a prevalence of 8.79% in Vadodara city.

An interesting piece of information observed was that the type of school (government or private) to which each individual had been exposed ceased to have statistical significance even though TDI was seen more in government school children, contradictory to a study carried out in 2013 by Ahlawat B et al⁹ where children attending private schools presented more traumatic injuries.

The most common form of injury were fractures involving only the enamel followed by fractures in enamel and dentin (O'Brien, 1994)¹⁰ comparable to present study. In the present study, enamel fractures dominated (67%) followed by enamel-dentin fractures (27%) and discoloration (8%).

The maxillary teeth are more frequently traumatized than mandibular teeth. The most frequently affected teeth were the maxillary central incisors, similar findings were observed by many studies^{4,5,8,9}. This probably relates to the vulnerable position of the maxillary central incisors. In addition, these teeth are frequently protruded and may

have inadequate lip coverage. In our study, association with risk factor like overjet, overbite and lip competency was non-significant.

In the present study it was found that the boys are more affected by trauma than girls, which corroborates the findings of other studies by Ravishankar *et al*⁵, Ahlawat B *et al*⁹, Patel *et al*⁸, Altun C *et al*¹¹, David J *et al*¹² and Cavalcanti AL *et al*¹³. This may be attributed to the behavioural factors, with the boys tending to be more energetic, more physical and inclined toward vigorous outdoor activities as compared to girls.

The majority of TDIs occurred at home and at school during leisure activities including contact and non contact sports. They were the main activities causing children to fall and were related to the aetiology of TDIs. The findings are similar to those in other reported studies Altun C *et al*¹¹ and Adekoya- Sofowora CA *et al*¹⁴.

Parents may lack information concerning the consequences of trauma to the teeth, as 97.7 % of the traumatic injuries in our study, did not result in a professional dental consultation to assess the problem. This finding is similar to a study conducted by Rai SB; Munshi AK¹⁵ on South Kanara school children. They reported a TDI prevalence of 5.29 %, out of which only 1.68% of the cases with traumatized teeth had undergone treatment. In case of the present study, this may be due to the lack of dental awareness amongst the parents. Along with seeking dental care, patient must be educated about the use of protective devices such as mouth guards which may help to reduce the incidence and severity of dental injuries during sports.¹⁶

Identifying the etiological factors makes it possible to establish preventive measures aimed at avoiding future injuries. This is especially so when in today's scenario the concept of conservation, retention, and prevention of tooth structures is topmost on the list of priorities. Improvements in the physical environment, closer supervision of children and adoption of health safety policies are likely to have a positive impact on the prevention of traumatic dental injuries. Families and the educational authorities must provide safe environment for children to play such as provision of specific and appropriate public places for sports activities with impact absorbing surfaces which could minimize injuries when children fall.¹⁷ It is also important that children should be supervised while they are playing to minimize the rate at which they fall and sustain TDIs and early orthodontic treatment in predisposed children may be an effective preventive strategy.

The teaching of injury epidemiology and injury prevention to healthcare workers and to the parents should be

improved. Health promotion policies should aim to create an appropriate and safe environment as well as increase awareness of such hazards. Dental emergencies should be dealt with high proficiency and should provide prompt standard of care, as such these injuries are the target of dental emergency care providers. In many countries, the majority of 12-year-old children have untreated dental trauma, with risk of pain, disfigurement and spreading infections with pulpal involvement. This condition can result in tooth loss at a relatively young age. Relief of pain is the predominant treatment demand of populations. People from disadvantaged communities do not visit clinics for preventive intervention or for restorative treatment to preserve their teeth. This attitude can be changed by education and motivation and demand for more preventive treatment and changes in lifestyle conducive to good oral health. As such changes will take time, to bring about the changes; oral health promotion (OHP) is the cornerstone of oral care. Oral health promotion forms an integral component of BPOC¹⁸ (Basic Package of Oral Care) to bring awareness of what is possible. The successful introduction of BPOC in a community relies to a large extent on good communication among all concerned. Traditional western oral health care should be replaced by a service that follows the principles of Primary Health Care. This implies that more emphasis should be given to community-oriented promotion of oral health. Treatment that is affordable for governments and individuals should also receive more attention. Using this approach, the level of untreated dental disease will become manageable. A package of oral care (BPOC) aims to reach all people at a much lower cost than traditional oral health services. Oral Urgent Treatment (OUT), one of the components of BPOC, provides basic emergency oral care. Services are targeted at the emergency relief of oral pain, management of oral infection and dental trauma (TDI) through Oral Urgent Treatment (OUT). Access to this component of basic oral care is a fundamental right for everyone. Therefore, governments must take the responsibility to establish and maintain a functional OUT service that is accessible and acceptable to the entire population.

All these efforts are thus expected to improve the present scenario and bring down the figures we have in our studies.

CONCLUSION

An effort can be made to reduce the prevalence of traumatic injuries by taking into consideration the following measures:

1. The use of intraoral and extraoral devices which protects the face and teeth from trauma.
2. Educational programs where by the children and their

parents are given information regarding the preventive and treatment aspects of traumatic injuries to teeth.

3. Health promotion policies should aim to create an appropriate and safe environment.

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Presentations of Acute Stroke Treated with Thrombolysis: A Clinical Profile

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Abstract

Introduction: Cerebrovascular accident is a leading cause of disability adjusted life years. With the advent of the therapeutic procedure of thrombolytic therapy, hope for the alleviation of the significant morbidity faced by these patients was seen. Along with the therapeutic procedure came the contradictory question of whether the benefits of truly outweighed the risks associated with the procedure.

Aims & Objectives: To (1) create a profile of patients who have undergone Intra-venous Thrombolysis (IVT), Intra-arterial Thrombolysis (IAT) or IVT-IAT bridge therapy in a tertiary care hospital, (2) to compare the procedures and (3) to correlate their outcomes with a number of associated factors.

Materials & Methods: Design: Cross-sectional, Record Based Study – Retrolective Data Collection. Setting: Tertiary Care Centre in Mangalore, Karnataka, India. Participants: All cases of acute stroke, treated with IAT or IVT or IAT-IVT bridge therapy, as defined by the inclusion and exclusion criteria for undergoing thrombolysis in stroke patients.

Main Outcome Measures: Permission was obtained from the Institutional Ethics Committee of Kasturba Medical College, Mangalore (Manipal University) to carry out the research. Approval was obtained from the Medical Superintendent to access hospital records. Data was collected in a semi-structured proforma. The data was collated and analysis was carried out using convenience sampling.

Results: 25 non-randomized cases were studied. The mean ages were: men - 58 years and women - 57 years. Most patients were brought in between 0-3 hours. The commonest territory of infarction was the left MCA territory, and the commonest presenting symptom was right hemiparesis. IVT was more commonly used but IAT showed better outcomes. Hypertension was the most common associated risk factor (64.00%), and IAT showed a better outcome in hypertensives. MRS 6 was seen 100.00% in bridging therapy, 26.67% in IVT and 0.00% in IAT.

Conclusions: IAT generally presented with a better outcome. Aphasia was related to a better outcome and facial palsy, to a poorer outcome.

Keywords: Bridge therapy, Cerebrovascular accident, Intra-arterial thrombolysis, Intra-venous thrombolysis, Stroke

INTRODUCTION

Cerebrovascular accident is a leading cause of disability adjusted life years in all ages. According to the Global burden of disease 2004 update by the WHO, cerebrovascular disease ranks 6th with a DALY of 46.6 million across all age groups.¹⁻³ Stroke has a devastating manifestation and equally crippling consequences. With the ever changing modalities of treatment, clinicians have been targeting to not only reduce the mortality of a disease, but to also reduce its morbidity by improving the long term outcome

of the patient, post treatment. With the advent of the therapeutic procedures of intra-venous thrombolysis (IVT) and intra-arterial thrombolysis (IAT) with plasminogen activators [rt-PA – *recombinant technology plasminogen activators*], hope for this was found as opposed to simply arresting the progression of stroke.⁴ The NINDS (National Institute of Neurological Disorders and Stroke) and ECASS (European Co-operative Acute Stroke Study) did clinical trials and the 2 most significant findings were found contradictorily to be as follows:

1. The outcome of patients after 90 days was much better.
2. The incidence of intra-cerebral haemorrhage was significantly increased. Now the biggest question that arose from this was – do the benefits of IVT and IAT outweigh the risks associated with it?^{5,6}

The basis for the study was instituted on the following trains of thoughts – therapeutic procedures are compared well in controlled settings; however when actually instituted in a mass population, how would a past history of specific drug usage or any associated co-morbidities affect the outcome after therapy?⁷ As IAT and IVT popularised, although the FDA (U.S. Food and Drug Administration) approved IVT was more commonly used, IAT had shown better outcomes. So, how do these procedures both compare to each other individually?⁸ It was also seen, that till date, the process of thrombolysis is still under review to compare the outcome of a patient with the associated risk of intra-cerebral haemorrhage.⁹

MATERIAL & METHODS

The aims of this study were to (1) Create a profile of patients who have undergone IVT, IAT or IVT-IAT bridge therapy in a tertiary care hospital in Mangalore, Karnataka, India, (2) Compare the more commonly used procedure of IVT as opposed to IAT and IVT-IAT bridge therapy with respect to their outcomes (3) Associate a number of factors (e.g. Risk factors, time between stroke and being brought to the hospital etc.) with the outcomes of the patients who have undergone IVT, IAT or IVT-IAT bridge therapy.

The study period was between 1 May 2012 to 31 July 2012, and the study design was a cross-sectional, record based study and retrolective data collection was done. The study was set in a tertiary care centre in Mangalore, Karnataka, India. All cases of acute stroke, treated with Intra-arterial and Intra-venous thrombolysis were the study subjects taken into consideration and the inclusions were: all the patients that: (1) presented with acute stroke, (2) underwent treatment with intra-arterial and intra-venous thrombolysis. The exclusions were all the patients that (1) presented with acute stroke that did not undergo treatment with IAT/IVT as defined by the exclusion criteria for undergoing intra-arterial and intra-venous thrombolysis, (2) had any other forms of intra-cerebral lesions.

The sample size was of 25 patients [All patients with acute stroke that were treated with IVT, IAT or IVT-IAT bridge therapy] and the sampling technique used was non-probability universal sampling (Convenience Sampling). The instrument used to carry out the research was a semi-structured proforma. Data collection was done after obtaining permission from the Institutional Ethics

Committee as well as permission to access the Medical records from the Medical Superintendent. The data obtained was then entered into the proforma (outcome assessment was done using the Modified Rankin Scale – MRS), collated, and data analysis was subsequently performed.

RESULTS

The study on the presentations with acute stroke treated with thrombolysis, were done with respect to 25 cases obtained from procedures carried out at a tertiary care centre in Mangalore, Karnataka, India.

Of the 25 cases, 19 (76.00%) cases were males and 6 (24.00%) cases were females. The mean age of men was seen to be 58 years and that of women was seen to be 57 years. Most cases were brought in to the hospital within the time window of 0-3 hour, one in the 3-4.5 hour time window and one in the 4.5-6 hour time window. The most commonly infarcted territory was the left MCA territory which accounted for 48.00% of the total cases, which was then followed by the right MCA territory which accounted for 20.00% of all the cases. The most common presenting symptom was hemiparesis (64.00% - right sided hemiparesis, 16.00% - left sided hemiparesis). Out of the cases being studied, it can be clearly seen that hypertension is the most significant underlying risk factors, being present in 64.00% of the total cases. 44.00% of people presented with a history of diabetes mellitus, and 36.00% of the cases presented with a history of cardiac disease. Only 8.00% of the cases were smokers, whereas 48.00% were non-smokers. IVT was carried out in 60.00% of the patients whereas IAT was carried out in 32.00% of the patients. IVT-IAT bridging therapy was used in only 8.00% of the cases. Of the outcomes of the cases being studied, 26.09% of all the cases had an MRS score of 6 i.e. dead. The remaining 73.91% show outcomes of an MRS between 0 – 5. 12.00% of the total cases that were treated and had the best possible outcome of MRS 0 underwent IVT. But, 25.00% of all the cases that underwent IAT had an outcome of MRS 0 as opposed to only 20.00% of those that underwent IVT. 26.67% of IVT cases resulted in death (MRS 6), as opposed to 0.00% of IAT cases having an MRS of 6. 100.00% of the bridging therapy using combined IAT and IVT therapy resulted in an MRS score of 6.

DISCUSSION

The finding of a larger number of males as opposed to females was generally unremarkable due to the biased nature of the study, as all cases being treated were considered. However, as pointed out by Arnold M. *et al*¹⁰;

the sex of the patient did not show a significant impact on the outcome of the recanalization rates and outcomes of patients being treated with thrombolysis. It can also be inferred that age group of patients are not specific to the gender of patients. But it is also important to remember that in a community based study, the age might have played an important factor in bringing patients in the right time window (as, perhaps stroke may not be suspected so easily in younger people, and older people may have been less mobile – thus causing both groups to be noticed as well as brought in to the hospital late). But, as shown by Costello CA *et al*¹¹, age over 80 years was not seen to be associated with an increased haemorrhagic transformation after the thrombolysis of stroke, and so it can be taken in to consideration that outcomes had very little to do with the ages of the patients. The territory of occurrence of stroke was in accordance with the fact that occlusion of the MCA accounts for approximately 90% of all strokes and about two thirds of all first strokes (Table 1).¹² The proportions of the presenting symptomatology and grades of power of the limbs were in accordance with the proportions of the infarcted territories (Table 2). The role of hypertension, diabetes mellitus and cardiac disease were in accordance with the basis of the pathophysiology of a stroke.⁴ Although a very small proportion of cases were seen to be smokers, the detrimental effects of smoking are very well known in the pathophysiology of many diseases, and so no conclusive statement can be drawn (Tables 3 and 4). IVT was seen to be the commonly used treatment modality than IAT – which remains in accordance with the norm.¹³ No formally defined cut-off score on the MRS exists to allow a distinction between a good and a bad outcome and hence only a very subjective statement can be made about the demarcation (Table 5).

The cases being studied adhere along the norms of the guidelines for thrombolysis therapy, and no major anomalies or deviations of the basic characteristics of the patients were seen that would cause or require a major amendment to the remainder of the factors being studied and associated. A higher overall proportion of IVT having an MRS of 0 was probably attributed to the fact that generally was a larger number of cases that underwent IVT. The scale however does substantiate in favour IAT over IVT, as when looked at individually, IAT yielded a higher number of outcomes of an MRS 0, and follows through with the same statement for an MRS of 1, 2 and 3. The sole discrepancy could be made when there were more cases of IVT with an MRS of 4 and 5. But, the scale skews to prefer IAT once again when no cases of IAT were seen to result in an MRS of 6 (Table 5). IAT generally resulted in a much better outcome than the procedure of IVT, despite being less commonly and more judiciously used, as supported by Zhang B *et al*¹² study concluding that IAT was more effective

Table 1: Basic characteristics of patients who presented with acute stroke and underwent thrombolysis

Characteristics	Total cases	% out of total cases	Males	% males	Females	% females
Total cases	25	100.00	19	76.00	6	24.00
Age						
40-49	6	24.00	4	66.67	2	33.33
50-59	8	32.00	6	75.00	2	25.00
60-69	7	28.00	6	85.71	1	14.29
70-79	4	16.00	3	75.00	1	25.00
Time window						
0-3	19	76.00	15	78.95	4	21.05
3-4.5	5	20.00	3	60.00	2	40.00
4.5-6	1	4.00	1	100.00	0	0.00
Infarct Territory						
Right MCA	5	20.00	4	80.00	1	20.00
Left MCA	12	48.00	10	83.33	2	16.67
Right ACA	1	4.00	0	0.00	1	100.00
Left ACA	1	4.00	1	100.00	0	0.00
Left PCA	2	8.00	1	50.00	1	50.00
Pontine	1	4.00	1	100.00	0	0.00
Left PCA & MCA	1	4.00	1	100.00	0	0.00
Left MCA, ACA, PCA	1	4.00	1	100.00	0	0.00
Left & Right ICA	1	4.00	0	0.00	1	100.00

Table 2: Presenting symptoms and presenting power of patients who presented with acute stroke and underwent thrombolysis

Characteristics	Total cases	% of total cases	Males	% males	Females	% females
Symptoms						
Right hemiparesis	16	64.00	12	75.00	4	25.00
Right hemiplegia	3	12.00	3	100.00	0	0.00
Left hemiparesis	4	16.00	3	75.00	1	25.00
Left hemiplegia	3	12.00	2	66.67	1	33.33
Aphasia	12	48.00	9	75.00	3	25.00
Right homonymous hemianopia	3	12.00	2	66.67	1	33.33
Left homonymous hemianopia	0	0.00	-	-	-	-
Facial palsy	2	8.00	1	50.00	1	50.00
Sweating	1	4.00	1	100.00	0	0.00
Vomiting	1	4.00	1	100.00	0	0.00
Presenting power						
Right side						
0	8	32.00	6	75.00	2	25.00
1	0	0.00	-	-	-	-
2	5	20.00	4	80.00	1	20.00
3	4	16.00	3	75.00	1	25.00
4	2	8.00	1	50.00	1	50.00
5	2	8.00	2	100.00	0	0.00
Left side						
0	3	12.00	2	66.67	1	33.33
1	1	4.00	1	100.00	0	0.00
2	0	0.00	0	-	0	-
3	0	0.00	0	-	0	-
4	0	0.00	0	-	0	-
5	17	68.00	13	76.47	4	23.53

Table 3: Presence of risk factors & relevant history in patients who presented with acute stroke and underwent thrombolysis

Characteristics	Total cases	% of total cases	Males	% males	Females	% females
Risk factors						
Hypertension	16	64.00	12	75.00	4	25.00
Diabetes mellitus	11	44.00	9	81.82	2	18.18
Cardiac disease	9	36.00	8	88.89	1	11.11
Obesity	0	0.00	0	0.00	0	0.00
Smoker	2	8.00	2	100.00	0	0.00
Raised haematocrit	1	4.00	0	0.00	1	100.00
Blood lipids	4	16.00	4	100.00	0	0.00
OCP	0	0.00	-	-	0	0.00
Past history						
Family history of stroke	5	20.00	3	60.00	2	40.00
Previous episode of stroke	1	4.00	1	100.00	0	0.00
Long term therapy	0	0.00	0	0.00	0	0.00
Associated treatment	3	12.00	2	66.67	1	33.33

Table 4: Absence of risk factors & relevant history in patients who presented with acute stroke and underwent thrombolysis

Characteristics	Total cases	% of total cases	Males	% males	Females	% females
Risk factors						
Hypertension	6	24.00	5	83.33	1	16.67
Diabetes mellitus	10	40.00	8	80.00	2	20.00
Cardiac disease	9	36.00	6	66.67	3	33.33
Obesity	9	36.00	5	55.56	4	44.44
Smoker	11	44.00	8	72.73	3	27.27
Raised haematocrit	7	28.00	5	71.43	2	28.57
Blood lipids	6	24.00	3	50.00	3	50.00
OCP	0	0.00	-	-	0	0.00
Past history						
Family history of stroke	4	16.00	3	75.00	1	25.00
Previous episode of stroke	8	32.00	5	62.50	3	37.50
Long term therapy	8	32.00	5	62.50	3	37.50
Associated treatment	8	32.00	5	62.50	3	37.50

than IVT in allowing patients to achieve independence, (Table 6) alongside the fact that the safety of the procedure of IAT within 6 hours was comparable to the safety of a narrower window period of 4.5 hours in IVT. Looking at the outcomes of patients treated with thrombolysis with respect to the territories of infarction - the definitive implications that can be drawn are that - (a) the territory in which infarction occurs supports the normal trend of IAT

Table 5: Treatment given to, and, outcomes of patients who presented with acute stroke and underwent thrombolysis

Characteristics	Total cases	% of total cases	Males	% males	Females	% females
Thrombolysis						
IVT	15	60.00	11	73.33	4	26.67
IAT	8	32.00	6	75.00	2	25.00
IVT and IAT	2	8.00	2	100.00	0	0.00
MRS						
0	5	21.74	5	100.00	0	0.00
1	3	13.04	1	33.33	2	66.67
2	5	21.74	4	80.00	1	20.00
3	2	8.70	1	50.00	1	50.00
4	1	4.35	0	0.00	1	100.00
5	1	4.35	1	100.00	0	0.00
6	6	26.09	5	83.33	1	16.67

Table 6: Comparison of the outcomes of the treatment of patients who presented with acute stroke and underwent thrombolysis

	Thrombolysis		
	IVT	IAT	IAT & IVT
Total cases			
No. of cases	15	8	2
% of total cases	60.00	32.00	8.00
MRS Score			
0			
No. of cases	3	2	0
% of total procedure	20.00	25.00	0.00
% of total cases	12.00	8.00	0.00
1			
No. of cases	1	2	0
% of total procedure	6.67	25.00	0.00
% of total cases	4.00	8.00	0.00
2			
No. of cases	3	2	0
% of total procedure	20.00	25.00	0.00
% of total cases	12.00	8.00	0.00
3			
No. of cases	1	1	0
% of total procedure	6.67	12.50	0.00
% of total cases	4.00	4.00	0.00
4			
No. of cases	1	0	0
% of total procedure	6.67	0.00	0.00
% of total Cases	4.00	0.00	0.00
5			
No. of cases	0	1	0
% of total procedure	0.00	12.50	0.00
% of total cases	0.00	4.00	0.00
6			
No. of cases	4	0	2
% of total procedure	26.67	0.00	100.00
% of total cases	16.00	0.00	8.00
Unknown			
No. of cases	2	0	0
% of total procedure	13.33	0.00	0.00
% of total cases	8.00	0.00	0.00

Table 7: Association of the infarct territory with the treatment of the presentation of acute stroke and their respective outcomes

Infarct Territory	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Right MCA	IVT	0 (0.00)	0 (0.00)	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)	1 (33.33)
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Left MCA	IVT	2 (40.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (60.00)
	IAT	2 (50.00)	2 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (100.00)
Right ACA	IVT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Left ACA	IVT	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Left PCA	IVT	0 (0.00)	1 (50.00)	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Pontine	IVT	-	-	-	-	-	-	-
	IAT	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Left PCA & MCA	IVT	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Left MCA, ACA, PCA	IVT	-	-	-	-	-	-	-
	IAT	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Left and Right ICA	IVT	-	-	-	-	-	-	-
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-

Table 8: Association of presenting symptoms with the treatment of the presentation of acute stroke and their respective outcomes

Symptoms	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Right hemiparesis	IVT	3 (33.33)	1 (11.11)	1 (11.11)	1 (11.11)	0 (0.00)	0 (0.00)	3 (33.33)
	IAT	1 (20.00)	2 (40.00)	1 (20.00)	1 (20.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Right hemiplegia	IVT	-	-	-	-	-	-	-
	IAT	1 (50.00)	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Left hemiparesis	IVT	0 (0.00)	0 (0.00)	1 (25.00)	0 (0.00)	1 (25.00)	0 (0.00)	2 (50.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Left hemiplegia	IVT	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Aphasia	IVT	2 (33.33)	0 (0.00)	1 (16.67)	0 (0.00)	0 (0.00)	0 (0.00)	3 (50.00)
	IAT	1 (20.00)	1 (20.00)	2 (40.00)	1 (40.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Right homonymous hemianopia	IVT	0 (0.00)	1 (33.33)	0 (0.00)	1 (33.33)	0 (0.00)	0 (0.00)	1 (33.33)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Facial palsy	IVT	-	-	-	-	-	-	-
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	1 (50.00)	0 (0.00)	1 (50.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Sweating	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Vomiting	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)

Table 9: Association of presenting power of the right side with the treatment of the presentation of acute stroke and their respective outcomes

Presenting power (right side)	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
0	IVT	0 (0.00)	0 (0.00)	1 (50.00)	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)
	IAT	0 (0.00)	1 (33.33)	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (100.00)
1	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
2	IVT	1 (50.00)	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	1 (33.33)	1 (33.33)	0 (0.00)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
3	IVT	2 (66.67)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
4	IVT	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
5	IVT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-

Table 10: Association of presenting power of the left side with the treatment of the presentation of acute stroke and their respective outcomes

Presenting power (left side)	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
0	IVT	0 (0.00)	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (50.00)
	IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
1	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
2	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
3	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
4	IVT	-	-	-	-	-	-	-
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
5	IVT	3 (42.86)	1 (14.29)	2 (28.57)	0 (0.00)	1 (14.29)	0 (0.00)	0 (0.00)
	IAT	2 (28.57)	2 (28.57)	2 (28.57)	1 (14.29)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (100.00)

generally giving a better outcome than IVT, (b) that IVT is the more common mode of treatment, however at the same time it not only gives a good outcome, but also supports the fact that contradictorily, the risks of death is equally large, and (c) territory of infarction does not seem to greatly affect the outcomes of the specific treatment procedures, as the outcomes as seen are either [i] in case of IVT – either very good or result in death [ii] in case of IAT – MRS was generally around the scores of 1-3, apart from the exception in the right MCA territory, and [iii] bridging therapy resulted in an MRS of 6 for the proportion of cases treated by it (Table 7). Concordant with the above relationship of infarct

territories with the treatment modality employed and their outcomes, the presenting symptoms followed the guidelines placed by the above findings; i.e. the relationships were associated with the normal physiological presentations as determined by the territories of infarct. Patients with aphasia were seen to a good outcome of an MRS of 0, 1, 2 or 3. Aphasia therefore can be highlighted as a key feature to administer thrombolysis – it is not only easy to recognise and therefore report, but also may be further stressed on because of the association of a good prognostic outcome with it. Facial palsy on the other hand yielded in 100% MRS 5, and may be an indicator of a bad prognostic outcome

Table 11: Association of presence of risk factors with the treatment of the presentation of acute stroke and their respective outcomes

Risk factors	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Hypertension	IVT	3 (30.00)	1 (10.00)	1 (10.00)	1 (10.00)	1 (10.00)	0 (0.00)	3 (30.00)
	IAT	0 (0.00)	2 (66.67)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (100.00)
Diabetes mellitus	IVT	2 (28.57)	0 (0.00)	0 (0.00)	1 (14.29)	1 (14.29)	0 (0.00)	3 (42.86)
	IAT	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Cardiac disease	IVT	1 (25.00)	0 (0.00)	1 (25.00)	1 (25.00)	0 (0.00)	0 (0.00)	1 (25.00)
	IAT	0 (0.00)	2 (66.67)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Smoker	IVT	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Raised haematocrit	IVT	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Blood lipid	IVT	2 (66.67)	0 (0.00)	0 (0.00)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-

Table 12: Association of absence of risk factors with the treatment of the presentation of acute stroke and their respective outcomes

Risk factors	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Hypertension	IVT	0 (0.00)	0 (0.00)	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)	1 (33.33)
	IAT	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (33.33)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Diabetes mellitus	IVT	1 (20.00)	1 (20.00)	2 (40.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (20.00)
	IAT	2 (50.00)	0 (0.00)	1 (25.00)	0 (0.00)	0 (0.00)	1 (25.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Cardiac disease	IVT	2 (33.33)	1 (16.67)	0 (0.00)	0 (0.00)	1 (16.67)	0 (0.00)	2 (33.33)
	IAT	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (33.33)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-
Obesity	IVT	3 (33.33)	1 (11.11)	1 (11.11)	1 (11.11)	1 (11.11)	0 (0.00)	2 (22.22)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Smoker	IVT	3 (33.33)	1 (11.11)	1 (11.11)	0 (0.00)	1 (11.11)	0 (0.00)	3 (33.33)
	IAT	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)
Raised haematocrit	IVT	3 (42.86)	0 (0.00)	0 (0.00)	1 (14.29)	1 (14.29)	0 (0.00)	2 (28.57)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Blood lipid	IVT	1 (16.67)	1 (16.67)	0 (0.00)	0 (0.00)	1 (16.67)	0 (0.00)	3 (50.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-

(Table 8). The distribution of presentations with lower powers on the respective sides of the body were concordant to the side of infarction, and the results, 2 things could be seen – (a) IAT generally gave a better proportion of MRS scores closer to the value of 0. (b) No overly apparent associations of presenting power and outcome were seen, possibly due to the amalgam of symptoms leading to each case having too many variables for the presenting power to show any possible direct correlations with the outcome respective to the treatment (Tables 9 and 10). The presence

of hypertension yielded an almost similar outcome profile of patients in case of IVT therapy both in the presence and absence of this risk factor. No clear correlation can be seen between risk factors with regard to the type of therapy administered and their outcomes. In fact, a better outcome in many cases of patients with associated risk factors may have presented because – maybe their symptoms may have precipitated more obviously and they may also have been under constant watch due to previous warning for possible episodes as such – and hence they may have been brought

Table 13: Association of presence of relevant past history with the treatment of the presentation of acute stroke and their respective outcomes

Past history	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Family history of stroke	IVT	1 (20.00)	1 (20.00)	0 (0.00)	1 (20.00)	1 (20.00)	0 (0.00)	1 (20.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Previous episode of stroke	IVT	0 (0.00)	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Associated treatment	IVT	0 (0.00)	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IAT	0 (0.00)	1 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	IVT & IAT	-	-	-	-	-	-	-

Table 14: Association of absence of relevant past history with the treatment of the presentation of acute stroke and their respective outcomes

Past history	Procedure	MRS (number of cases (%))						
		0	1	2	3	4	5	6
Family history of stroke	IVT	2 (50.00)	0 (0.00)	1 (25.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (25.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Previous episode of stroke	IVT	3 (37.50)	1 (12.50)	1 (12.50)	0 (0.00)	1 (12.50)	0 (0.00)	2 (25.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Long term therapy	IVT	3 (37.50)	1 (12.50)	0 (0.00)	1 (12.50)	1 (12.50)	0 (0.00)	2 (25.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-
Associated treatment	IVT	3 (37.50)	1 (12.50)	0 (0.00)	1 (12.50)	1 (12.50)	0 (0.00)	2 (25.00)
	IAT	-	-	-	-	-	-	-
	IVT & IAT	-	-	-	-	-	-	-

to the hospital as soon as the symptom was detected (Tables 11 and 12). Relationships with outcomes could not be conclusively compared with respect to a family history of stroke, long-term therapy with Aspirin/Clopidogrel/Warfarin or treatment of associated co-morbidities, as these were only treated with IVT, and none were treated with IAT (Tables 13 and 14).¹³

The biggest limitation of this study was the bias and non-randomization of the sample. This was primarily difficult to achieve because of the extremely selective nature of the procedure of thrombolysis, as well as the small subset of cases available to be studied. From this also stemmed the fact that there was not a significant enough distribution – between the factors being studied, and the therapeutic procedures of IVT, IAT and bridging therapy – for an apt comparison to be made at many points.

CONCLUSION

To probe more deeply into the subject and now start looking at the therapy with respect to the outcomes: larger test groups, stemming from these risk factors can be studied to show a more conclusive association with stroke and its

presentation in groups undergoing thrombolysis. The biased nature of the sample prevents the study from carrying out a conclusive, statistically significant test and hence only their relative proportional significance can be commented on. Of the other recorded associated co-morbidities and risk factors, it may be worth looking at the outcomes of thrombolysis on patients with HIV; this study cannot make a conclusive statement with reference to the fact that the outcome was of an MRS score 6, as there is only one recorded case. IAT must most definitely be further investigated for the purpose of conventional therapy, and must definitely be considered and further researched and developed for the first line of treatment in acute stroke patients, considering the fact that it almost consistently showed better outcomes individually as a therapeutic modality, as well as with respect to the factors being investigated. Thrombolysis should also be evaluated with respect to how exactly to define a good outcome in patients undertaking it, so a quantitative measurement of whether truly ‘the risks outweigh the benefits can be determined’. The study also shows that specific symptoms such as aphasia and facial palsy showed a correlation of a better and a worse outcome respectively. Hence, they may be evaluated so a prognosis may be determined beforehand, and the therapeutic approach may be developed so as to

achieve better outcomes in these patients and fulfil the purpose of the initial idea behind thrombolytic therapy in patients presenting with acute stroke.

ACKNOWLEDGMENTS

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Chest Ultrasonography - A Quick and Accurate Diagnostic Tool in Pediatric Emergency Department and Intensive Care Unit

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Abstract

Chest ultrasonography is a useful diagnostic tool for pediatricians. It can be used to complete and widen the general objectives of clinical examination in emergency situations, at the patient's bedside.

The diagnosis of pneumonia in children relies on history, physical examination, blood tests and chest X-rays. These methods have a low accuracy in the pediatric population that is even lower in the critically ill.

The relative ease of bedside ultrasound examination and the availability of user-friendly, inexpensive, portable equipment have made chest ultrasonography an interesting and alternative investigating tool in various situations, because it offers accurate information that is of diagnostic and therapeutic relevance.

In this article we attempt to summarize the equipment, examination techniques, normal findings and various signs of chest ultrasonography seen in multiple pathologies like pneumonia, pneumothorax, pleural effusion, interstitial syndrome, consolidations, pulmonary edema, ETT placement and diaphragmatic movements.

Keywords: Chest Ultrasonography, Pneumonia, Pneumothorax, Pleural Effusion, Sonographic Interstitial Syndrome

INTRODUCTION

Traditionally, air has been considered the enemy of ultrasound and the lung has been considered an organ not amenable to ultrasonography examination. Chest diagnostic imaging is essential when dealing with a critically ill patient. At present, direct visualization of the lung parenchyma is performed with a chest x-ray (CXR) and computed tomography (CT), with the patient in the supine position. In the ICU, chest x-rays are only performed on patients in the supine position. The x-ray beam is positioned directly onto the chest at a film distance of less than six feet. In fact, when the x-ray beam does not fall tangentially on the diaphragm dome and the mediastinal structures, a correct diagnosis of the "silhouette sign" may not be achieved. Hence it may result in diagnostic errors regarding pleural effusions, parenchymal consolidation, and alveolar-interstitial syndrome.¹

While the computed tomography scan of the chest is considered the gold standard for the imaging diagnosis of all the conditions listed so far, it is neither inexpensive nor available within the intensive care unit, necessitating potentially dangerous transport to the radiology department. In addition, it exposes the patient to high doses of ionizing radiation. Ultrasound compares favorably with computed tomography scan in the diagnostic ability for some disease conditions, most prominently pneumothorax, where it has a sensitivity of 92% compared to computed tomography. In addition it is relatively cheap and is readily available at the bedside making it easier and faster than chest X-ray or CT.²

Each computed tomography chest exposure gives the patient an effective dose of eight msv, equivalent to four hundred chest x-rays, this is equivalent to 3.6 years of natural background radiation from earth (one x-ray

exposure gives the patient an effective dose of 0.02 msv equivalent to three days of natural background radiation)

Current estimates indicate that a single CT scan exposure will result in a lethal malignant transformation of at least one in every 10,000 patients or greater.³

For many years transthoracic ultrasound was limited exclusively to the examination of pleural effusions. However, over the past few years ultrasonography of the pleural space and lung parenchyma is gaining a wide consensus in different conditions in clinical practice, particularly in emergency conditions.⁴

The limitations of computed tomography along with the risk of ionizing radiations mandate the search for a safe diagnostic tool for patients with suspected pneumonia, with the advent of portable bedside ultrasound.⁵ Chest scan using ultrasound can be adopted as a simple and non-invasive method for evaluating children with pleural and parenchymal pathology especially pneumonia which, allows close follow-up and avoids the use of ionizing radiation.⁶ Lung ultrasound may be used to distinguish viral from bacterial pneumonia.⁷

The relative ease of bedside chest ultrasonography (chest ultrasonography) as an interesting alternative method in different respiratory situations, because it offers accurate information that is of diagnostic and therapeutic relevance. This is why it is often used by intensivists who ask radiologists for a second opinion in difficult or complicated case studies. Experienced radiologists can integrate chest ultrasound findings with better radiological techniques, which mean that the contribution of a radiologist is often necessary in patient management.

BASICS

Lung sonography is made feasible by the interpretation of ultrasound artifacts that arise from the chest wall and pleural surface. A brief review of the relevant normal anatomy will provide the framework to facilitate an understanding of the various patterns one may encounter when performing lung sonography.

Superficial structures (skin, subcutaneous fat, pectoral and intercostal muscles) conduct sound waves well and do not generate artifacts.

The cortex of each rib reflects ultrasound waves and blocks their transmission, resulting in a hyperechoic (bright) appearance to the near-field (superficial) cortex, with distal shadows extending to the edge of the ultrasound screen (Figure 1).

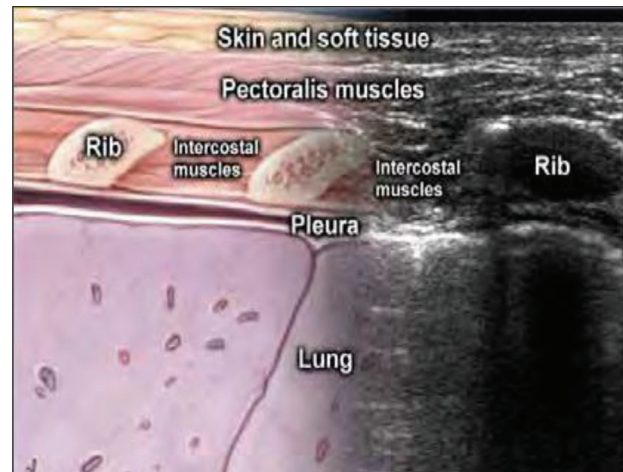


Figure 1: Anatomical drawing fused with corresponding ultrasound image demonstrating the superficial chest wall structures. (www.philips.com/CCEMeducation)

The parietal and visceral pleurae appear as a single hyperechoic “pleural line” just deep to the internal intercostal muscles. This line will “slide” or oscillate from side to side on the ultrasound screen, representing movement of the pleural surfaces as the lung expands and contracts during the respiratory cycle.

Normal lung parenchyma is not visualized because it is composed primarily of air, which scatters and impedes the transmission of sound waves. The dramatic difference in the acoustic characteristics of soft tissues and the lung makes the lung surface a particularly strong reflector of ultrasound waves, and is responsible for creating a number of reverberation artifacts that provide valuable information about the lung’s current pathophysiology.⁸

The more the ultrasound waves are reflected back the brighter the image:

- Hyperechoic (bright): air, diaphragm, periostium.
- Echogenic: liver, kidney, muscle.
- Hypoechoic: (dark) fluid, bloodfat.

A-Lines

A-lines occur when sound waves pass through the superficial soft tissues and cross the pleural line encountering air (as in a pneumothorax) or tissue that is almost completely composed of air (as in normal lung, or pathologic states that do typically affect the lung parenchyma such as asthma or chronic obstructive pulmonary disease). These waves are reflected strongly by this tissue/air interface and reverberate, or “bounce” back and forth, between the transducer and lung surface (Figure 2).

A Lines:

- Horizontal lines parallel to the pleural line.
- Seen in normal lung parenchyma.

- If A lines present along with lung sliding: asthma.
- If A lines present without lung sliding – Pneumothorax should be suspected.

B-Lines

B-lines occur when sound waves pass through the superficial soft tissues and cross the pleural line encountering a mixture of air and water (as in pulmonary edema, pneumonia, lung contusion, acute respiratory distress syndrome, etc.). In this instance, the mixed density of the lung parenchyma causes reverberation artifact within the lung, giving rise to discrete laser-like vertical hyperechoic reverberation artifacts that arise from the pleural line, extend to the bottom of the screen without fading, and move synchronously with lung sliding.

When several B lines are visible the term “Lung rocket`s” is used.

B lines:

- Arise from the pleural line and extend up to bottom of screen.

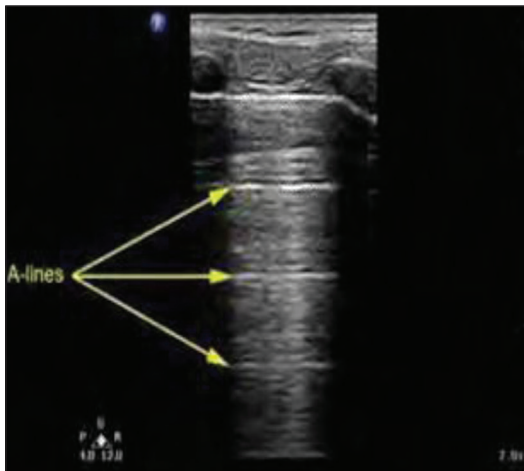


Figure 2: Ultrasound image demonstrating A-lines. The A-lines are the bright horizontal lines deep to the pleural line. A-lines are a classic reverberation artifact; the distance from the skin to the pleural line equals the distance from the pleural line to the first A-line, the first A-line to the second A-line, and so forth

- Move with lung sliding.
- Correlate with alveolar interstitial pattern – 7 mm apart B-lines, interlobular septa process: diffuse interstitial fibrosis.
- <3 mm apart closely spaced B lines intra alveolar process: pulmonary edema (smooth pleura) or acute respiratory distress syndrome (rough pleura) (Figure 3a and b).

Z lines are short, broad, ill defined, vertical comet tail artifacts arising from the pleural line but not reaching the distal edge of the screen and are not B lines (Figure 3c). These are found in normal persons as well as in those with pneumothorax. They are less echogenic than the pleural line, usually taper off at after 2-4 centimetres, they do not erase A lines and do not move with lung sliding. E lines are comet tail artifacts can be seen superficial to the pleural line in those with parietal emphysema or parietal echogenic multiple foreign bodies (shot gun pellets). These are called E lines (subcutaneous emphysema).⁷

TRANSDUCER SELECTION

There has been a great deal of controversy regarding the optimal choice of transducer for lung sonography. In recent years, however, prospective studies using high-frequency linear, low-frequency curvilinear and low-frequency sector transducers have demonstrated that the performance and interpretation of lung sonography is not transducer-specific.

Curvilinear low frequency transducer (3-5 MHz) is used best for clear A and B line determination. High frequency (12-15 MHz) because of better resolution can be used for assessing lung sliding. Lower frequency transducers will provide more depth penetration but will sacrifice image quality; high-frequency transducers provide better resolution but will sacrifice depth penetration. Phased array cardiac probes are even better in this regard. We generally use pediatric cardiac phased array or curvilinear (5-8 MHz) probe and demonstrate lung sliding and high frequency linear probe (12-15 MHz) for pleural pathology.

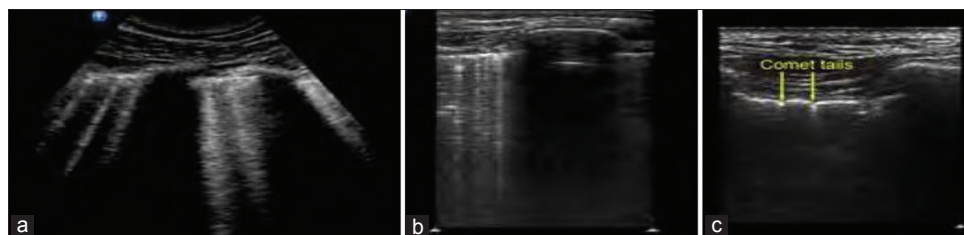


Figure 3: (a and b) The ultrasound images demonstrating B-lines. B-lines are discrete laser-like vertical hyperechoic reverberation artifacts that arise from the pleural line, extend to the bottom of the screen without fading, and move synchronously with lung sliding. Figure A was obtained using a low-frequency curved transducer; the Figure b and c were obtained using a high-frequency linear transducer. (c) – Z lines not touching the bottom

IMAGE OPTIMIZATION

We recommend that features that decrease artifacts such as compound imaging, speckle reduction, etc. are de-activated for the lung exam. Some newer ultrasound systems have “lung” exam types or presets that have been optimized for lung imaging. These exam types deactivate the software-processing features that decrease artifacts. Lung examtype preset optimizes other ultrasound parameters such as depth, focal zone and gain settings.⁹

EXAMINATION TECHNIQUE

The patient can be scanned supine or erect, anteriorly, posteriorly or in the mid axillary line intercostal (between the ribs) depending on the pathology being assessed. When scanning the lungs it is recommended to scan in the longitudinal plane between the ribs to assist in identifying the level of the pleura between the rib artifacts (Figure 4).

For optimization of the image transducer should be placed always perpendicular to the pleural line. Transducers directional indicator should be always oriented towards patients head in longitudinal views. The left side of the image on the monitor corresponds to the cephalad part of the patient in all longitudinal scans, on all lateral/axial imaging the left of image corresponds to right half of patient. Positioning the probe under the xiphoid with cranial inclination allows evaluation of the pericardium. Subcostal and intercostal acoustic windows of the liver and the spleen are used to study the lung base and pleural effusion.

NORMAL LUNG FINDINGS

- Pleural line.
- Bat wing sign.

- Sliding lung
- A lines.
- Lung pulse.
- B lines/Comet tails.

The pleural line “slides” (to and fro movement) with respiration. The movement is distinctive as the surrounding chest wall structures are still or move in an opposite direction to the lung. This is pleural/lung sliding. The sliding movement seen is the lung which moves on respiration. Its amplitude is greater at the base than at the apex where it may be inappreciable. The image best seen in M mode as the superficial parietal layers are motionless and have a horizontal pattern of lines while the area deep to the pleural line appears “granular” as the motion of the pleural line is reflected all over this area. This is also known as the “seashore sign” (Figure 4b).

In B-Mode scanning the normal Pleura is seen as a white (echogenic) line which moves with respiration (lung sliding). The pleura are situated posterior (below) to the ribs which appear as white curved lines with a dark shadow behind. This is known as the “Bat sign” (Figure 4a) When scanning intercostally you may see the liver and diaphragm covered by lung during inspiration. This is known as the “Curtain sign.”

LUNG PULSE

As the heart beats the movement of the heart is transmitted through the lung which is demonstrated in M-mode as a regular motion artifact through the seashore pattern to the level of the pleura (Figure 5a and b). The Lung Pulse is easily identified when the patient holds their breath. If there was a pneumothorax present the



Figure 4: Six-zone examination protocol of lung scanning in pediatrics. Top Row: Anterior Midclavicle Line; Middle Row: Lateral Midaxillary Line; Bottom Row: Posterior Paraspinal Line. Probes in transverse (columns in A and D) and parasagittal planes (columns B and C) in anterior and posterior lung fields, and in transverse and coronal planes (middle row) in lateral lung fields (Modified)

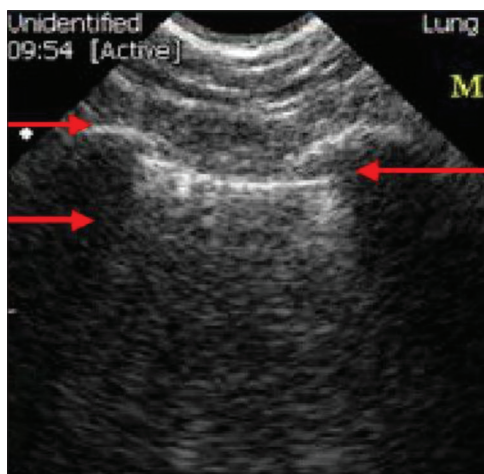


Figure 4a: Lung sliding sign, Bat sign and A Lines. (normal lung)

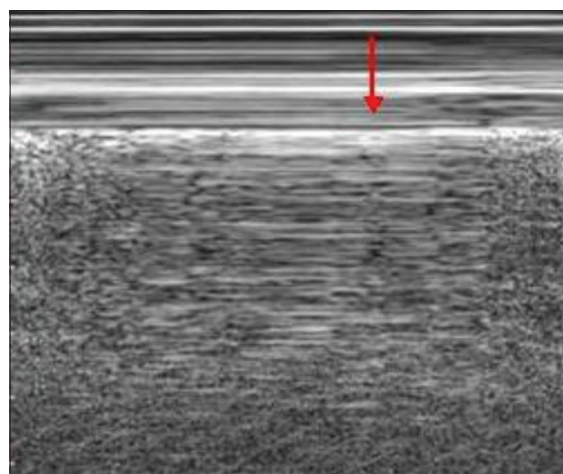


Figure 5b: Pause in the respiration on the ventilator causing loss of sea shore sign but demonstrates a lung pulse hence excluding a pneumothorax

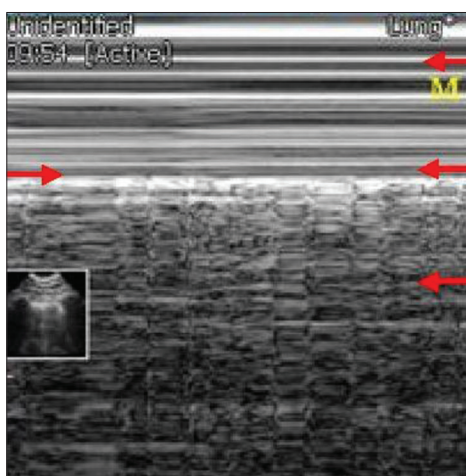


Figure 4b: Seashore sign by M mode

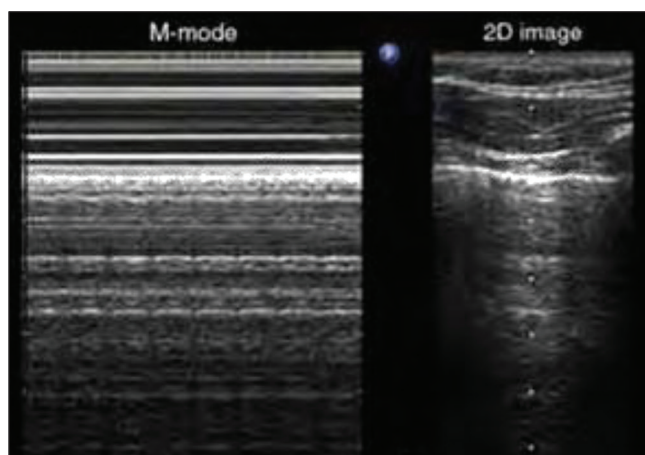


Figure 5c: Side by side M-mode and 2D tracing demonstrating a "lung pulse." On the M-mode, note the rapid, regular, intermittent movement at and below the pleural line, corresponding to the movement of the pleural line with each heartbeat

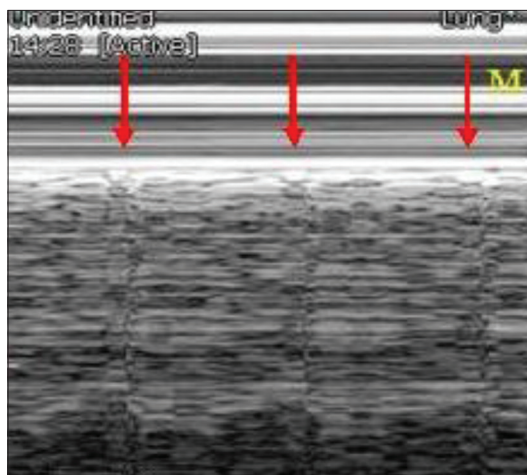


Figure 5a: Lung pulse extending from the bottom of the screen where the heart is positioned behind the lung to the pleura

motion of the heart beat could not be identified within the Barcode. (Figure 5c)

ABNORMAL LUNG

Pneumothorax

In supine patient, a free pneumothorax usually collects in the anterior and non dependent area. The signs are best appreciated with a high frequency probe. A probe grater than 5 MHz is advisable. High frequency linear (such as a vascular) probes will give a clearer picture.

Absence of lung sliding: This is a sign of pneumothorax. If lung sliding is present, pneumothorax can be ruled out. However, loculated posterior, mediastinal and apical pneumothoracies can be missed. For a complete examination, the probe must be placed along the anterior, lateral and posterior intercostals spaces and observation must include a whole respiratory cycle at each point. In an M mode, this will show absence of the normal granular

pattern deep to the pleural line - the whole picture will show a number of horizontal lines.

Absence of B-lines: Although is not specific for pneumothorax, the presence of B-lines rules out a pneumothorax. B-lines with absent lung sliding may be seen in lower lobe consolidations. Absent B-lines with lung sliding present may be seen in emphysema or hyper inflated lung states.

The Lung Point

Since the air in the pleural space moves anterior and the lung collapses to a dependent position posteriorly, there is a point, usually in the lateral regions where the lung and air may be visualized in the same view. On moving from anterior to lateral, a pneumothorax pattern gives way to a fleeting appearance of lung pattern in a particular location of the chest wall. 'Lung point has a sensitivity of 66% and a specificity of 100%' (Figure 6a-c). Lung pulse sign has been explained earlier to rule out pneumothorax.

PLEURAL EFFUSION

Ultrasound is more efficient than a normal physical examination and more useful than chest X-ray in pleural effusion diagnosis. Even minimal pleural effusion (about 5 mL), which is not evident on a chest X-ray, can be detected. If the chest X-ray demonstrates hemi thorax opacity, the chest ultrasonography can detect quickly and with certainty the nature of the opacity, differentiating liquid and solid components of the opacity. Transudates are normally anechoic, while exudates are corpusecular. Hyper-reflectant air bubbles in effusion suggest hydro pneumothorax. In M mode Sinusoidal pattern noted. (Figure 7a)

Chest ultrasonography is the most accurate technique in indicating the organized or septate nature of effusion (Figure 7b) and can help to avoid the ineffectiveness of evacuative thoracocentesis. Chest ultrasonography is also more accurate in quantifying pleural effusion than a chest X-ray.

To quantify the pleural fluid in basal lung scan. The distance between base of the lung and pleura that is milliliters (ml) of fluid = distance in millimeters (mm) x 20.

Fluid (Black) will collect in the dependent area of the chest cavity. The patient can be scanned supine or erect, depending on the condition of the patient, in the mid axillary line or slightly posterior to the mid axillary line. Methodical surveillance of the chest cavity in the longitudinal plane from medial to lateral and superior to

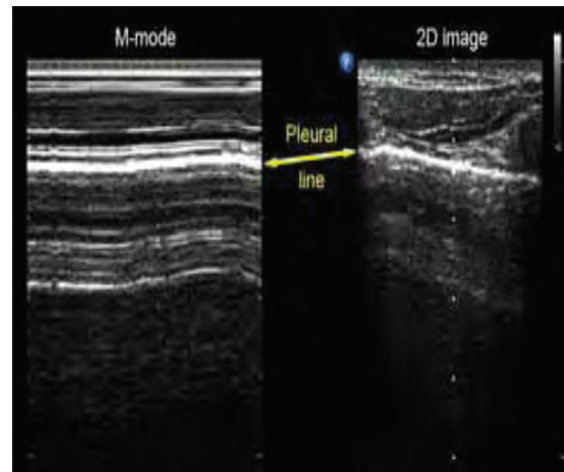


Figure 6a: Bar code sign in M mode in pneumothorax

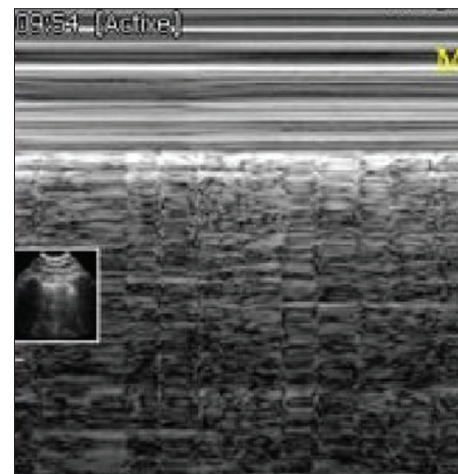


Figure 6b: Seashore sign normal lungs

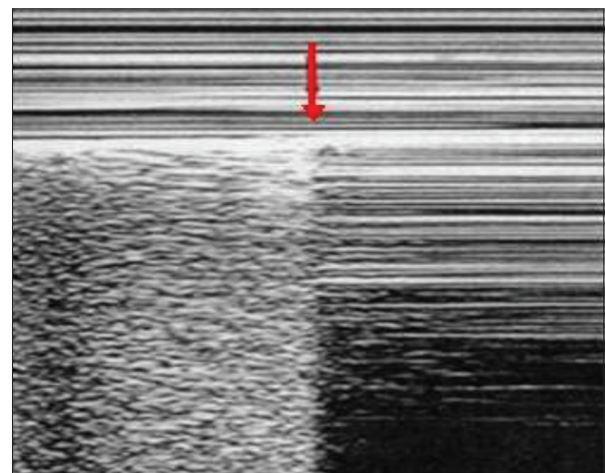


Figure 6c: Seashore sign, Lung point, Barcode sign

inferior will assist in locating the largest pool of fluid in the erect patient. The largest pool of fluid can be marked for thoracocentesis.

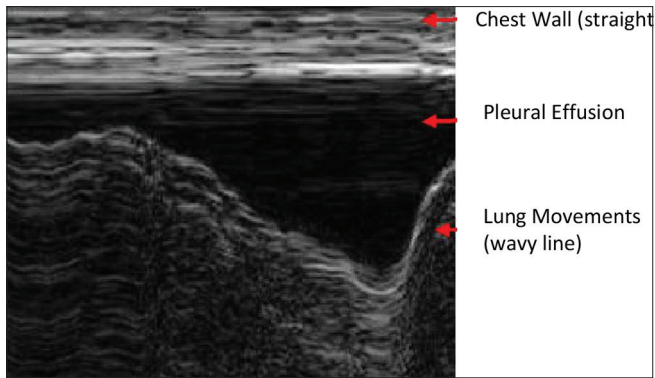


Figure 7a: Pleural effusion in M mode "Sinusoid Pattern"

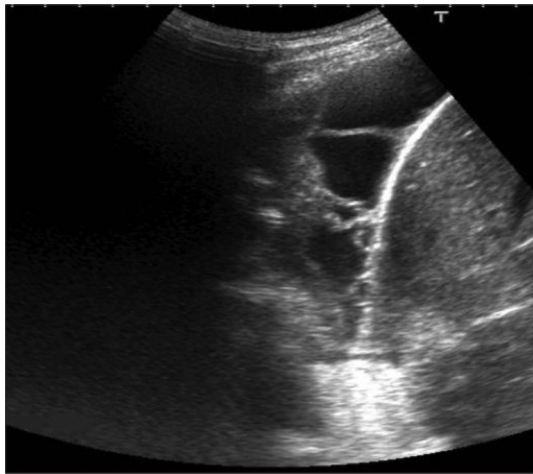


Figure 7b: Pleural effusion with septae

LUNG CONSOLIDATION

Water is a good transmitter of ultrasound and a consolidated lung is water rich. Alveolar consolidation usually reaches the lung surface. Collapsed lung segments can resemble consolidation sonologically. It appears as poorly defined hypoechoic lung tissue structure. In contrast, the tissue structure of normal lung cannot be seen. What is seen is the artifacts that arise at the pleural line. (Figure 8a)

Within the consolidation, hyperechoic punctiform images can be seen corresponding to air in the bronchi - a so called ultrasound air bronchogram. These air bubbles can be seen to move in the bronchi during respiration. The size of a consolidation does not change with respiration, in contrast to a pleural effusion.

Sonologically diagnosed alveolar consolidation is abnormal pathology in thorax, should arise from pleural line, tissue like pattern, superficial boundary should be pleural line (otherwise pleural effusion), and deep boundary should be irregular. It helps in assessing degree of aeration

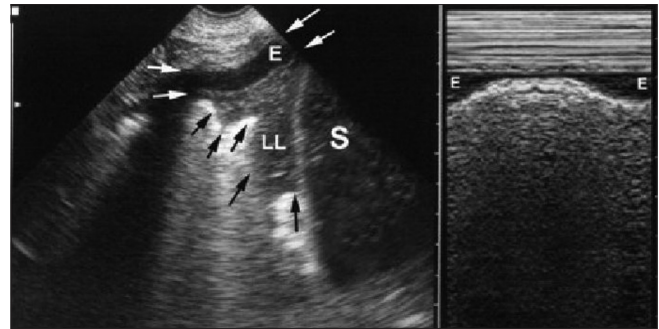


Figure 8a: Left lower lobe consolidation (LL), Pleural effusion (E), White arrow showing pleural lines, black arrows showing irregular Lower border of consolidation and transitional zone (shred Line) That is connected with aerated lung and B lines. M Mode showing Sinusoid sign

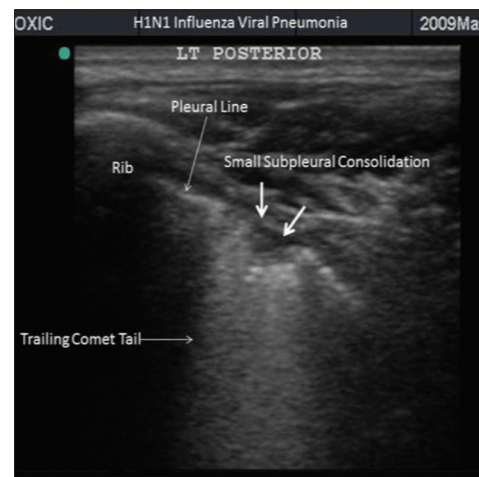


Figure 8b: Viral pneumonia shows sub pleural consolidation with comet tails (B Lines). But there is minimal sonographic air bronchograms, no A Lines which indicates bacterial pneumonia

as a measure of effectiveness of therapy (Positive end expiratory pressure effect or antibiotic effect on the consolidation).

Consolidations of an inflammatory nature have an irregular profile, with a hypo-anechoic heterogeneous structure and a branching bronchogram. When present, the air bronchograms resemble reverberant ribbon images with a branch-shaped aspect. Due to loss of volume during atelectasis, the bronchial tubes present a parallel aspect, rather than a branching one (the latter of which is typical of flogistic consolidations (Figure 8b).

In bronchial obstruction, a fluid bronchogram may be observed. The bronchus resembles tubular images, with hyperechoic walls and anechoic content.

In consolidation the lung volume is increased by fluid or tissue, but the bronchi are spared and retain their normal branching pattern. In atelectasis, overall lung volume is

decreased; supplying bronchi of the involved lung can be crowded together in very close apposition in one plane, appearing as parallel-running bright lines.

Occasionally when the bronchial tree is filled with fluid rather than air, as in mucoid impaction, ultra sound may demonstrate a branching pattern of anechoic or hypoechoic tubular structures within consolidated lung. Demonstration of fluid-filled bronchi, an appearance termed a sonographic or mucous bronchogram, is a specific indicator of pulmonary parenchymal consolidation, equivalent to the air bronchograms.

Sonographic air fluid bronchograms may not be visible, particularly in the peripheral lung. In this case color flow ultra sound demonstrates the normally branching pattern of pulmonary vessels in consolidated lung.

RECRUITMENT MANEUVERS OF LUNG AND ULTRASOUND EVALUATION

Consolidated parenchymal area, in a patient suffering from pneumonia is rich in water content. It causes hypoechoic area; once we recruit with positive pressure ventilation the hyper reflectant air reaches pulmonary consolidated area causing progressive reduction of its compactness. Consolidation is dimensionally reduced and partly replaced by normal air parenchyma, full of “B lines”, an expression of interstitial thickening (Figure 9).

INTERSTITIAL SYNDROME

A standard ultrasound probe in high resolution mode is used for this. It has been shown that multiple B-lines 7 mm apart are caused by thickened interlobular septa

representing interstitial edema whereas B-lines 3 mm or less apart are caused by ground glass areas characterizing alveolar edema. The number and intensity of B-lines increases with the degree of loss of aeration.

The “lung rockets” image consists of multiple “tails” fanning out from the lung surface. It originates from water-thickened interlobular septa. Functionally, they are a sign of dysfunction of the alveolar-capillary membrane. Increased extravascular lung water (EVLW) has multiple comet tails fanning out from the lung surface originating from water-thickened interlobular septa (Figure 10).

A normal lung contains much air and little water on the lung surface, so with sonographic imaging, no dense structures are visible in normal subjects. The normal ultrasound lung pattern is characterized by roughly horizontal, parallel lines.

But in pulmonary interstitial edema ultrasound picture shows roughly vertical, parallel lines. The comet-tail image is related to a small water-rich structure, below the resolution of the ultrasound beam surrounded by air, and this element has to be present at the surface of the lung. Subpleural interlobular septa thickened by edema perfectly combine all of these properties. The subpleural end of a thickened septum is too thin to be visualized by the ultrasound beam, but it is thick enough to “disturb” the beam and create a difference in acoustic impedance with the surrounding air.

In interstitial lung disease pleural abnormality and reduced lung gliding sign, spared areas, parenchymal consolidations, pleural effusions are more evident. But in pulmonary edema it is not.

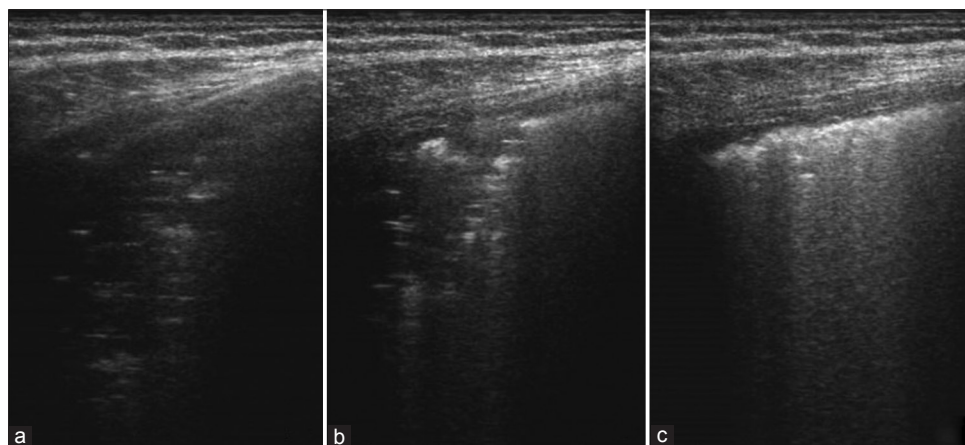


Figure 9: Recruitment maneuvers of lung and ultrasound evaluation. A Consolidated parenchymal area in patient suffering from pneumonia. B The hyper reflectant air aspect reaching the pulmonary consolidation and the progressive reduction of its compactness. C Recruitment: consolidation is dimensionally reduced and partly replaced by normal air parenchyma, full of “B lines”, an expression of interstitial thickening

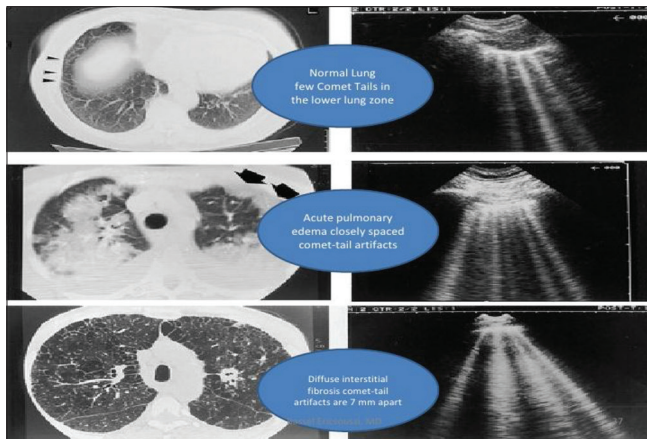


Figure 10: Comparison of the CT scans and ultrasound showing normal lung, interstitial lung disease and pulmonary edema.
Note the compactness and number of vertical B lines

DIAPHRAGMATIC MOVEMENTS

Diaphragmatic movements and its contractility were evaluated using ultrasonography after cardiac surgery resulting in phrenic nerve damage. Further it can be used in degenerative nerve disorders and severe sepsis causing diaphragmatic damage leading to difficult extubations.

Normal diaphragmatic movement is downwards during inspiration and opposite during expiration. In ultrasound this downward movement of diaphragm appears like an upward stroke white line (because diaphragm is coming towards the probe, where probe is in right and left hypochondriac region) (Figure 11).

In diaphragmatic paralysis the caudal movement (downwards) is absent during inspiration. There will be abnormal cephalad (upwards) movement during inspiration.¹⁰

Normal diaphragmatic movements in various maneuvers observed in M mode tracing (Figures 12 and 13).

ENDOTRACHEAL TUBE INSERTION

It has been used to confirm endotracheal intubation, position of the endotracheal tube after intubation, assess vocal cord movement, and diagnose end bronchial intubation (Figure 14).

Proximal Endotracheal tube malposition "endotracheal tube too high"

- Measure distance from vocal cord to tip of tube.
- Tip of tube should be visible above sternal notch.

Distal Endotracheal tube malposition

- Unilateral pleural sliding may indicate main stem intubation.

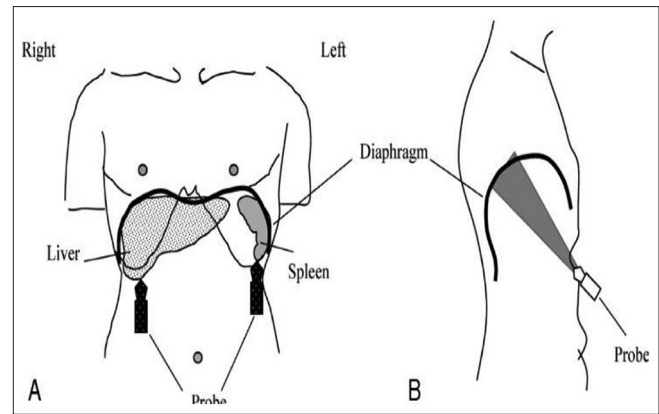


Figure 11: Picturised illustration of diaphragmatic movements and probe position and orientation

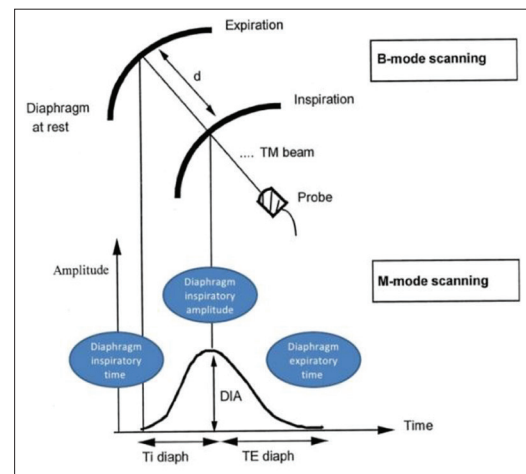


Figure 12: Picturised illustration of measurement of diaphragmatic movement

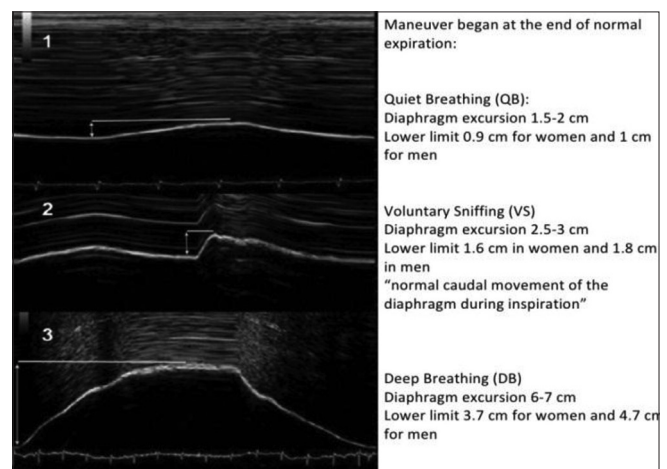


Figure 13: M Mode measurements of diaphragm movements in normal breathing, sniffing, deep breathing normal values of all manures

Combination of both may eliminate the need for chest X ray.¹¹

Laryngeal ultrasonography done by keeping the transducer on the left side of the neck just above the suprasternal notch, Figure A: shows normal anatomy of trachea showing white hyper echogenic shadow below circular air mucosal multiple interference that is esophagus. Figure b shows tracheal intubation with one more hyper echogenic mark in the trachea with small comet tail, not the esophagus is still in side by circular. Figure c note two concave structures side by side that means esophageal intubation (Figure 15).

SUMMARY

We usually follow FALLS (Fluid Administration Limited by Lung Sonography). In this protocol initially we evaluate fluid status by evaluating the heart like (pneumopericardium, pericardial effusion, increased pulmonary artery pressure, ventricular contractibility). Later we do follow modified blue protocol adjusting to pediatric cases (Figure 16).

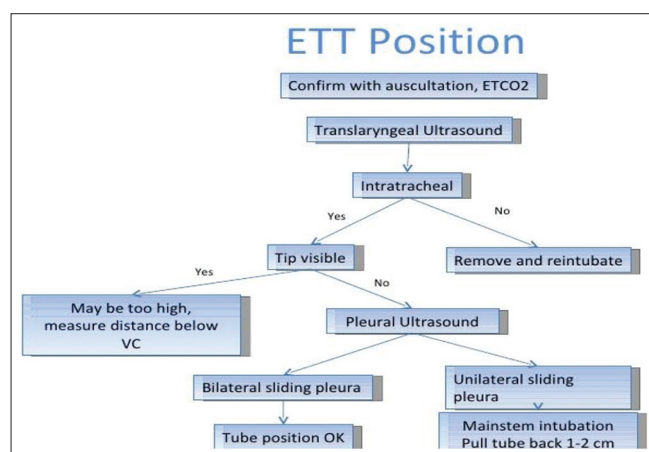


Figure 14: Complete guideline flow chart of Endotracheal tube position

LIMITATIONS

The correct use of chest ultrasonography requires appropriate training to acquire the necessary knowledge and technical skills. The limitations are those related to the use of ultrasound in other anatomical areas: the skill of the operator plays an important role.

Moreover, it is difficult to use this technique on obese patients with thick chest walls in addition; the technique's efficiency is limited in patients with subcutaneous emphysema. In chest ultrasonography, patients often lie in non-optimal positions, which limit the exploration of certain lung areas. Furthermore, the presence of drains and catheters can interfere with the appropriate placement of the transducer. In India all the doctors can not easily buy ultrasound equipment as they need many permissions and restrictions. This question touches on the classic medicolegal issues of critical ultrasound, which hampers its widespread use, but which can be reversed in the near future. We have elegant answers to the issue of time dependent situation, of increasing radiation mainly.¹¹⁻¹⁴ Obtaining the image and interpretation is mainly operator oriented.

CONCLUSION

Chest ultrasonography is an accurate method for the diagnosis of pneumothorax, alveolar-interstitial syndromes, parenchymal consolidations, and pleural effusion. It is an easily available, user-friendly, inexpensive medical technique that involves no ionizing radiation. Lung ultrasonography may be useful during epidemics or pandemics of acute respiratory illnesses for rapid point-of-care triage and management of patients. It can therefore be added to the armamentarium of critical care. However

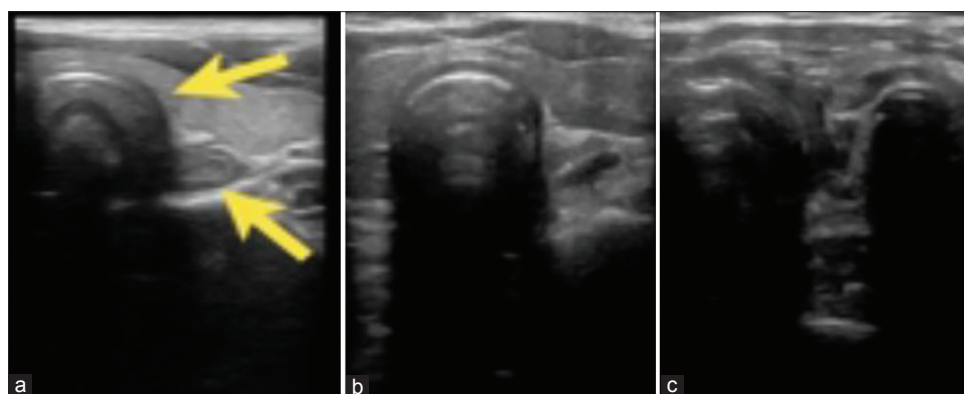


Figure 15: (a,b,c) Laryngeal ultrasonography done by keeping the transducer on the left side of the neck just above the suprasternal notch, Fig A shows normal anatomy of trachea showing white hyper echogenic shadow below circular air mucosal multiple interference that is esophagus. Fig B shows tracheal intubation with one more hyper echogenic mark in the trachea with small comet tail, not the esophagus is still in side by circular. Fig C note two concave structures side by side that means esophageal intubation

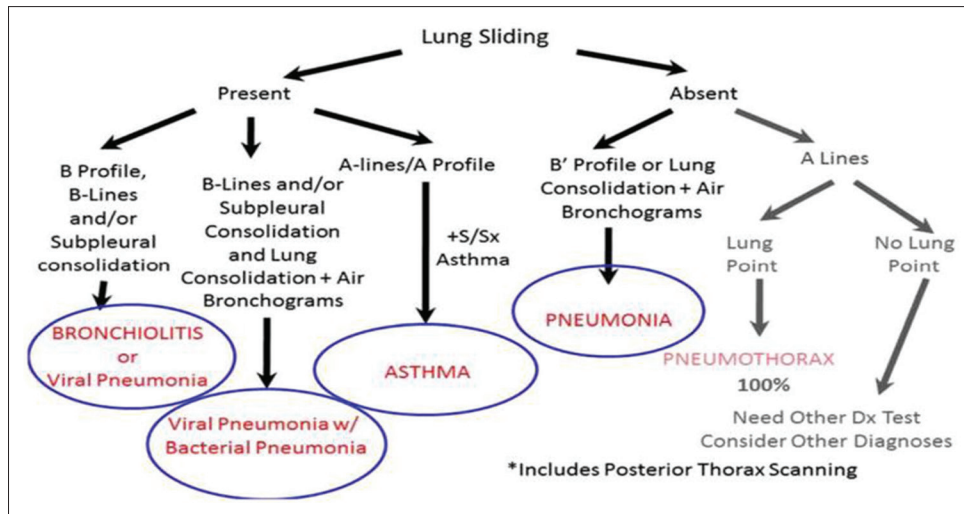


Figure 16: Bedside lung ultrasound in emergency protocol - modified for emergency department and intensive care unit. This protocol Includes posterior thorax scanning

chest x-ray continues to be the gold standard for lung related problems.

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Ultrasound as a diagnostic boon in Dentistry - A Review

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Abstract

TMJ imaging protocol begins with hard tissue imaging to evaluate the osseous contours, the positional relationship of the condyle and fossa, and the range of motion.

Many diagnostic means have been indicated for the diagnosis of temporomandibular disorders (TMD), including electrodiagnostic tests such as jaw-tracking devices, electro-myography, thermography, sonography for the evaluation of joint sounds, vibration analysis, and several imaging techniques. Such imaging techniques consist of plain and panoramic radiography, conventional and computerized tomo-graphy (CT) scan, arthrography, magnetic resonance (MRI) and radionuclide imaging. The use of ultrasonography for the diagnosis of tem-poromandibular joint (TMJ) disorders is uncommon.

Keywords: Temporomandibular joint (TMJ), Three Dimensional (3D), Two Dimensional (2D), Ultrasound

INTRODUCTION

After William Roentgen discovered x-rays in 1895, the head & neck region began to be explored in ways that had never been possible before the development of radiology grew at a good place until the World War II. Dental radiology has long played an exerting & critical diagnostic role in dentistry, never truer than now rapidly expanding array of imaging modalities. Recent decades have been the development of Computed Tomography, Magnetic Resonance Imaging, Nuclear Medicine and Ultrasonography. These imaging modalities that have revolutionized dental & medical diagnosis.¹

All diagnostic ultrasound applications are based on the detection & display of acoustic energy reflected from interfaces within the body.²

After the evolution of 2-D ultrasonography systems have been developed that are capable of preserving quantitatively the amplitude information termed gray scale ultrasonography.³ in the last decade, by combining advances in ultrasound image quality with recent advances in 3D visualization developed the 3D ultrasound which has demonstrated advantages both for diagnosis of disease

and in providing image guidance for minimally invasive therapy.⁴

The development of contrast agents for ultrasound has opened new horizons for this non-invasive modality for enhancing the echogenicity of blood and for delineating other structures of the body.^{1,5,6}

Its application in dentistry has been used to investigate salivary glands, cysts and tumors in the oral region and in diagnosis of temporomandibular joint disorders, midfacial fractures, fractures of mandibular condyle and ramus, cervical lymphadenopathy and swelling in oro-facial region. Ultrasound guided core needle biopsies recommended as a safe and reliable technique in the diagnosis of cervico-facial masses with a high diagnostic yield.⁶

GENERAL REQUIREMENTS FOR RADIOLOGICAL ULTRASOUND SCANNERS⁷⁻⁹

Minimum⁹

- Display examination details
- Electronic adjustment of focal zone
- Movable zoom box

- Simultaneous display of at least two modes
- Cineloop for 5 seconds at 25 frames per second
- Hard disk storage of adequate capacity
- Controllable signal processing facilities
- Tissue specific pre-sets capability
- Caliper accuracy of better than 2% or 0.5 mm
- Screen and hardcopy image distortion of less than 5%
- Tissue harmonic imaging

Desirable⁹

- High definition, variable size display magnification
- Extended field of view
- Digital beam former
- Cineloop up to one minute at 25 frames per second
- Ability to store images digitally (more than 0.5 Gb)
- Fast random access image review
- Removable storage media (DVD, CD or MO)
- Automated tissue specific pre-sets
- Customizable pre-sets and calculations for individual users and for different types of applications for all modes
- DICOM-3 standard
- Microbubble contrast imaging facility²

Safety and Quality Assurance (required)⁹

- Compliance with Medical Devices Directive
All newly delivered equipment should be checked in accordance with MDA DB9801 Supplement 1 Dec 1999: - Checks and Tests for Newly Delivered Medical Devices
- Annual electrical safety tests to be carried out by personnel/contractors trained in safety tests on ultrasound units
- Regular maintenance by qualified personnel for the planned lifetime of the machine
- Full maintenance and service contract with an appropriate organization
- Annual or biannual monitoring of the performance of the unit (QA) by qualified operators

Controls Needed⁷

- An overall sensitivity control to alter the amount of information on the screen.
- Separate controls to alter the surface (near) echoes and the deep (distant) echoes. These are known as near gain and far gain controls.
- A control (frame freeze) to hold the image on the screen so that it can be viewed for as long as necessary.
- A control to measure the distance between two points and distance between dots should be shown automatically in cm or mm on the screen.

Transmitter – most clinical applications use pulsed ultrasound in which brief bursts of acoustic energy are

transmitted into the body. The ultrasound transducer that is the source of these pulses is energized by application of precisely timed, high-amplitude voltage.²

Transducer – A transducer is any device that converts one form of energy to another. In case of ultrasound, the transducer converts electric energy to mechanical energy and vice versa.²

Ultrasound transducers use piezoelectricity, a principle discovered by Pierre Curie in 1880. Each transducer is focused at a particular depth.²

In pulsed operating modes, ultrasound pulses contain additional frequencies both higher and lower than preferential frequency. The range of frequency produced by a given transducer is termed its bandwidth. Generally, shorter the pulse of ultrasound produced by the transducer, greater the bandwidth.²

For continuous wave (CW) ultrasound devices, a constant alternating current is applied to the transducer, the alternating polarity producing a continuous ultrasound wave.²

Near field or Fresnel zone – Interference of pressure waves result in an area near the transducer in which the pressure amplitude varies greatly. This region is termed as the Near field or Fresnel zone.²

Far field or Fraunhofer zone – from the transducer at a distance is determined by the radius of the transducer and the frequency, the sound field begins to diverge and the pressure amplitude decreases at a steady rate with increasing distance from the transducer. This region is called the Far field or Fraunhofer zone.²

The shapes of scans from different transducers are –

1. Linear Arrays – Used for small parts, vascular and obstetric applications.⁷
2. Curved Arrays – linear arrays that have been shaped into convex curves.²
3. Phased Arrays
4. Two-Dimensional Arrays –
Receiver- The receiver detects and amplifies the weak signals and provides the means of compensating for the differences in echo strength, which result from attenuation by different tissue thickness by control of time depth compensation or time gain compensation (TCG). Another important function of the receiver is the compression of the wide range of amplitudes returning to the transducer into a range that can be displayed to the user.²

Image Display- Ultrasound signals may be displayed in several ways ^{-7,2}

1. A-Mode
2. M-Mode –
3. B-Mode
4. Real-time

Special Imaging Modes²

1. Harmonic imaging
2. Spatial Compounding –
3. 3-D Ultrasound

Image storage – the brightness and contrast of the image on this display are determined by the brightness and contrast settings of the video monitor, by the system gain setting and the TCG adjustments.²

Image quality –² the key determinants of the quality of an ultrasound image include its spatial, contrast, and temporal resolution, and freedom from certain artifacts.

Spatial resolution² – the ability to differentiate two closely situated objects as distinct structures is determined by the spatial resolution of the ultrasound device and must be considered in three planes, and there are different determinants of resolution in each of these.

Axial resolution² – the resolution along the axis of the ultrasound beam and is determined by the pulse length. Transducer operating at 5 MHz produces sound with a wavelength of 0.0308 mm.

Lateral resolution² – refers to resolution in the plane perpendicular to the beam and parallel to the transducer and is determined by the width of the ultrasound beam. It is controlled by focusing the beam, usually by electronic phasing, to alter the beam width at a selected depth of interest.

Elevation or azimuth resolution² – refers to the slice thickness in the plane perpendicular to the beam and to the transducer and is determined by the construction of the transducer and generally, it cannot be controlled by the user.

Ultrasound imaging and Doppler ultrasound are based on the scattering of sound energy by interfaces formed of materials of different properties through interactions governed by acoustic physics.² The sound waves used diagnostically in ultrasound have a frequency over 20 000 cycles per second (20 kHz), whereas the audible range for humans is up to 20 kHz.⁷

Sound waves are propagated through a medium by the vibration of molecules (longitudinal waves). Within the

wave, regular pressure variations occur with alternating areas of Compression, which correspond to areas of high pressure and high amplitude.

Rarefaction or low pressure zones where widening of particles occurs.

Interaction of Ultrasound with Tissue

This can be described by attenuation, reflection, scattering, refraction and diffraction.

Attenuation is the decrease in amplitude and intensity of wave as it travels through a medium.⁸ higher frequencies are more readily absorbed and scattered (attenuated) than lower frequencies.⁷

It is determined by the insonating frequency and the nature of the frequency of the attenuating medium and attenuation of common tissues.

Reflection means the waves are thrown back or return back to the transducer.² The way ultrasound is reflected when it strikes an acoustic interface is determined by size and surface of the interface.²

Refraction the change in direction of propagation is called refraction. If the sound has been refracted, the echoes detected and displayed in the image may, in fact, be coming from a different depth or location than is shown in the display. Increasing the scan angle so that it is perpendicular to the interface minimizes the artifact.²

Diffraction the ultrasound beam spreads out with distance from the transducer. This has the effect of lessening the intensity of the beam.²

Mechanism of Scanning⁷

Ultrasound pulses of the type produced by the scanners are of a frequency from 2 to 10 MHz. The duration of the pulse is about 1 microsecond and the pulses are repeated about 1000 times per second.⁷

The reflected ultrasound pulses detected by the transducer need to be amplified in the scanner. The echoes that come deep within the body are more attenuated than those from the more superficial parts, and therefore require more amplification. Ultrasound scanners have control that can alter the overall sensitivity, the “threshold”, of the instrument, as well as change the amplification of the echoes from different depths to achieve a balanced image.⁷

Three-dimensional (3-D) Ultrasound

Over the past few years, the development of real-time 3-D ultrasound imaging has revealed a number of potential

applications in image-guided neurosurgery as an alternative approach to open magnetic resonance (MR) and intra interventional computed tomography (CT).^{10,11}

In a 3D ultrasound examination, the 2D ultrasound images are combined by a computer to form an objective 3D image of the anatomy and pathology (Figures 1-4). This image can then be viewed, manipulated and measured in 3D by the physician on the same or another computer. Also, a 2D cross-sectional image can be generated in any orientation, without restriction, at any anatomical site, which may easily be registered with a previous or subsequent 3D image. Thus, 3D ultrasound imaging promises to overcome the limitations of 2D ultrasound imaging.^{4,10-12}

Scanning Techniques

Most 3D ultrasound imaging systems make use of conventional 1D ultrasound transducers to acquire a series

of 2D ultrasound images, and differ only in the method used to determine the position and orientation of these 2D images within the 3D image volume being examined.⁴

Advantages

1. 3-D imaging permits volume data to be viewed in multiple imaging planes and allows accurate measurement of lesion volume.²
2. It offers both for the diagnosis of disease and in providing image guidance for minimally invasive therapy.⁴
3. The major advantage of 3-D US over existing intra-operative imaging techniques are its comparatively low cost and simplicity of use.¹⁰
4. Its ability to measure the length, area or volume of organs or lesions in arbitrary orientations.⁴



Figure 1: Ultrasonographic picture of the swelling showing oval-shaped lesion with anechoic internal echo pattern and unchanged posterior wall echo. These features are suggestive of a dentigerous cyst

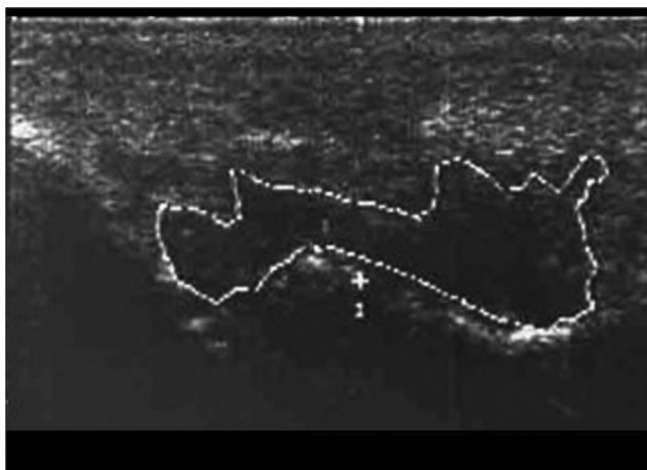


Figure 2: Ultrasonography picture showing anechoic lesion in the region of buccal space suggesting of buccal space abscess. (USG, 8 MH2 probe)

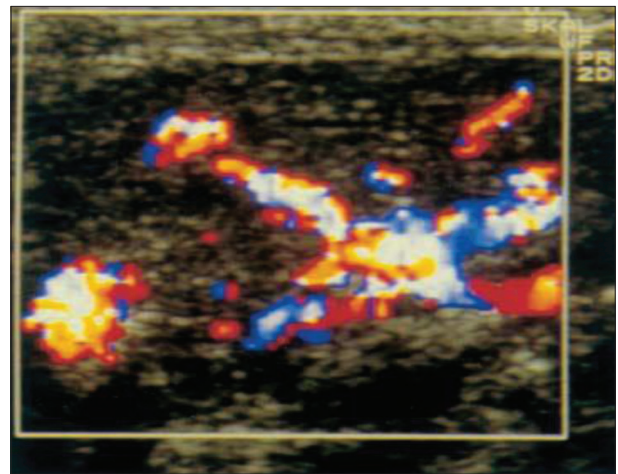


Figure 3: Longitudinal sonogram of the parotid gland. Unilateral hypoechoic swelling of the gland, color Doppler reveals hyperemia. Acute sialoadenitis was diagnosed

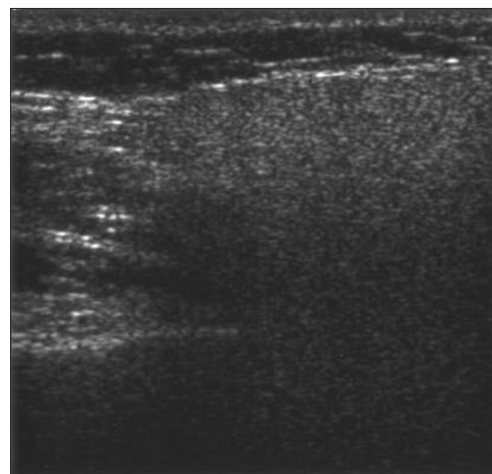


Figure 4: Transverse sonogram of the left parotid gland. Echogenic swelling of both parotid glands was present. The deep parts of the gland are not visualized due to strong acoustic attenuation. Sialoadenosis was diagnosed

Measurement Accuracy with 3D Ultrasound

1. Distance measurement - With a 3D image, distance measurements need not be made in the plane of an acquired 2D image, but instead can be made in any orientation.⁴
2. Measurement of cross-sectional area using 3D ultrasound- Using the multiplanar reformatting (MPR) technique, the 3D image can be 'sliced' in any orientation, to obtain the optimal cross section for the organ measurement.⁴
3. Volume measurement using 3D ultrasound- The availability of 3D images allows the measurement of organ volume using either manual or algorithmic techniques.⁴

Doppler Ultrasound

Doppler ultrasound is based upon the Doppler Effect. Christian Andreas Doppler (Austrian mathematician and physicist) 1841 proposed that the observed color of a star was caused by a spectral shift of white light that occurred because of the motion of the star relative to the earth. Doppler used analogies based on the transmission of light and sound. Although his theory on light was in error, Doppler's theories on the change in frequency of sound waves were correct.⁶

The Doppler Effect – the Doppler Effect, as the theory became known, is defined as “the observed changes in frequency of transmitted waves when relative motion exists between the source of the wave and an observer”. This theory was applied to many aspects of science, including astronomy and medicine.⁶

ADVANTAGES

1. It is a dynamic and readily available technique.¹³
2. It is particularly useful in the examination of superficial structures.¹³
3. It is widely available and relatively inexpensive.¹²
4. It is a non-invasive technique.¹²
5. It is well tolerated by the patient.¹³
6. It does not interfere with normal function.¹⁴
7. Artifacts are few.¹³
8. The technique is highly acceptable to most patients.¹³
9. Images are rapidly acquired.¹³
10. Images are simple to store and retrieve.¹⁵
11. Images obtained are easy to read once the observer is trained.¹⁶
12. It can be performed without heavy sedation.¹²
13. It has no known cumulative biological effects.¹⁸
14. It is proven to be reproducible and simple.¹⁷
15. Equipments are portable.¹⁹

16. It is easily accessible and painless.²⁰
17. It is a less discomfort, relatively rapid and examination can be performed even at the patient's bedside.²⁰
18. Its absolute non ionizing nature.²⁰
19. Equipments are relatively cheap.¹⁶
20. It is convenient to use.¹⁶
21. Its possibility of real time imaging.²¹
22. It helps to distinguish between solid and cystic lesions.²⁰
23. Its ability to detect non calcified pathological entities such as sialoliths.²¹

DISADVANTAGES

1. The technique is very operator- and equipment dependent.¹²
2. Clinically only the bone surfaces and not the whole cortex or spongiosa can be visualized in intact done due to ultrasound frequencies.²²
3. It has to be performed by experienced investigators.¹⁹
4. Images when archived they may be difficult to orientate and to interpret unlike CT and MR scans, which have acquired in standard reproducible scans.¹³
5. The difficulty of picturing the TMJ using ultrasounds depends on the limited accessibility of the deep structures, especially the disc, due to absorption of the sound waves by the lateral portion of the head of the condyle and the zygomatic process of the temporal bone.²³
6. Ultrasound images are affected by inherent noise accompanying the signal returned to the transducer which makes interpretation of the static images, and sometimes the dynamic ones as well and a nonmoving object will vary in appearance because of this noise.¹⁵
7. Ultrasonography waves do not visualize bone or pass through air, which acts as an absolute barrier during both emission and reflection.²³

Depending on the application and ultrasonic intensities it is divided into two-

Diagnostic ultrasound – the ultrasonic intensities used are typically 5 to 500 mW/cm² and it includes:

- Swellings in orofacial region
- Salivary glands disorders
- Periapical lesions
- Lymph nodes – benign/malignant
- Intraosseous lesions
- Temporomandibular disorders
- Assessment of masticatory muscles in temporomandibular dysfunction
- Congenital vascular lesions of head and neck
- Primary lesions of the tongue

- Fractures of mandibular condyle and ramus and midfacial fracture
- Detecting the foreign bodies
- Distracted mandibular bone
- Miscellaneous lumps and bumps of the head and neck
- Ultrasound guided
 - Core needle biopsy
 - Submandibular gland injection of botulinum toxin for hypersalivation in cerebral palsy
 - Basket retrieval of salivary stones

2. Therapeutic ultrasound – use intensities of 1 to 3 W/cm² and it includes –

- Myofascial pain
- Temporomandibular joint dysfunction
- Ultrasound guided lithotripsy of salivary calculi using an electromagnetic lithotripter
- Bone healing and osteointegration
- Oral Cancer
- Healing of full thickness excised skin lesion.
- Other applications-
 - Ultrasonic descaling
 - Modifications of the ultrasonic descaling
 1. Endodontics
 2. Surgical applications
 3. Other dental uses
 4. Ultrasonic cleaning baths

SUMMARY & CONCLUSION

Radiography has been widely used for obtaining a comprehensive overview of the maxillofacial complex. The clinical use of Radiography is limited by the uncertainty regarding the actual dimensions of structures.²⁴ Ultrasonography has revolutionized the world of medical imaging as a diagnostic and therapeutic aid. Though diagnostic ultrasound has been used as a reliable diagnostic tool in the medical field but still not found its place as a routine diagnostic aid in the orofacial region.

It is recognised as one of the most risk-free methods of evaluating any disease in the human. Ultrasound real time imaging has wide application in numerous diagnostic fields.

It has been suggested that it can provide useful information for the assessment of TMJ disorders. Despite the limitations that it is operator dependent, better standardization is required and normal parameters must be set and it remains potentially useful as an alternative imaging technique for monitoring TMJ disorders particularly for the diagnosis of articular disc displacement and joint effusion.

It may be acceptable treatment of choice in many types of clinical procedures involving maxillofacial bone.

It has several advantages over conventional radiography namely its non-invasive nature, easy reproducibility, possibility of real time imaging, its ability to detect non calcified pathological entities, relatively rapid and inexpensive technique.

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Evaluation of Performance of Single Bone Forearm as A Salvage Procedure in Different Clinical Scenarios – A Short Case Series

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Abstract

Patients frequently present with deformity of forearm with bone loss in either of the forearm bones due to various reasons. In this study two children suffering from chronic osteomyelitis and one having neglected Monteggia fracture were selected. In all three cases, single bone forearm reconstruction by radioulnar fusion was attempted successfully. Cosmetic and functional outcomes were evaluated and were satisfactory. Single bone forearm is a safe and effective salvage procedure in deformity of forearm with significant bone loss in different clinical scenarios not amenable to usual reconstructive techniques. This procedure also results in satisfactory range of motion with performance of normal daily activities, hand function and cosmetic value.

Keywords: Monteggia fracture, Osteomyelitis, Radioulnar fusion, Single bone forearm

INTRODUCTION

The forearm serves as a connecting link between elbow and wrist providing pronation and supination. These movements are associated with brain growth and differentiation of prehensile thumb based on evolution and human embryology.¹

The normal anatomy should be restored as close as possible as the movements are vital for our activities of daily living (ADL). Radius and ulna are complexly joined proximally through radiohumeral and radioulnar joints and distally through distal radioulnar and radiocarpal joints providing ideal biomechanics for elbow and wrist movements and also for forearm pronation and supination. Both the proximal and distal radioulnar joints are trochoid and reinforced distally with triangular fibrocartilage complex (TFCC).^{2,3}

The joints are further stabilised by intervening capsule, ligaments, muscles and tendons. The interosseus space

between the relatively straight ulna and curved radius is bridged by the interosseus membrane which is of vital importance to forearm rotations and often referred to as a modified joint. The interosseus membrane has both intervening oblique and transverse fibres and is thin distally and thick proximally.

The radius and ulna are rare sites for haematogenous osteomyelitis in children (<3%). The infection usually involves the metaphyses and can destroy the whole bone. In infants, the forearm involvement may be a manifestation of a multifocal infection. The acute infection presents with fever, pain, swelling, pseudoparalysis and occasionally, a compartment syndrome.⁴ Although cure rates have improved due to early detection and improved antibiotics, the diagnosis is not always obvious and may be delayed. Chronicity may occur resulting in a pathological fracture, sequestrum formation, discharging sinuses and pseudoarthrosis. The aim of this study is to evaluate the results of single bone forearm reconstruction in different situations.

CLINICAL MATERIAL

Three patients have had radio ulnar fusion at Dept. of Orthopaedics, IPGME & R, S.S.K.M Hospital, Kolkata in the last 2 years. Table 1 gives the indications for the operation, the age at that time, and the length of follow up.

CASE ONE

A 15 year old boy presented with history of gradually increasing deformity of left forearm with increasing difficulty in day to day activities for last 10 years following trauma. On examination there is varus and recurvatum deformity, wasting of biceps, triceps & forearm muscles, ROM of elbow 15-80 degree of flexion, 0-90 degree supination, no pronation, shoulder and wrist was normal and elbow was unstable (Figures 1 and 2).

An 8 cm posterior longitudinal incision was made half above and half below the elbow. Selection of the level of excision of radius was done by gentle firm downward forearm traction and marking over the radial shaft at the level of the proximal ulna. Trimming of the sclerosed end of proximal ulna was done till punctuate bleeding appeared. Radial shaft was cut at the pre-marked area and proximal radius excised. Distal shaft of radius is delivered from radial to ulnar compartment so that ulnar part comes in to close contact to radial cut ends in straight position of forearm. TENS nail was used to fix the ends. Cortico-cancellous bone graft was given at the reduced site (Figure 3). Wound was closed in layers. Stitches were removed after 12 days. Initially limb was immobilised in 30 degree flexion and full supination. Thereafter from 3rd week onwards patient's elbow was kept in adjustable elbow splint initially for twelve hourly in flexion and extension alternately for three weeks then six hourly alternately (Figure 4).

Deformity was corrected in 20 degree of supination. ROM of elbow - 0-130 degrees of flexion. Length was gained by 4 cm from previous length. Sound radiological union of radius and ulna was achieved in 6.5 mths (Figures 5 and 6). Hand function is regained with functionally stable elbow with better cosmetic appearance (Figure 7).

Table 1: Details of three radio ulnar fusions

	Indication	Age	Length of Follow Up
1.	Neglected Monteggia fracture	15 yrs	18 months
2.	Chronic Osteomyelitis	5 yrs	17 months
3.	Chronic Osteomyelitis	12 yrs	18 months

CASE TWO

A 12 yr old girl presented with chief complaints of pain and gradual bowing of left forearm for last two years following an incident of acute osteomyelitis of left forearm bones. On examination there was antero medial bowing of



Figure 1: (a and b) Pre operative clinical photographs

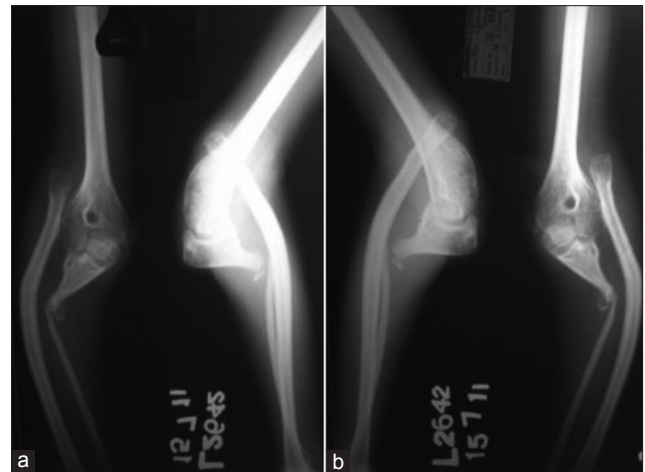


Figure 2: (a and b) Pre op X-ray



Figure 3: (a and b) Post op X-ray

forearm, wasting of muscles, ROM:15-90 degree of flexion, 0-20 degree of supination, pronation nil, wrist was normal. X-Ray showed diffuse sclerosis of radius with diaphyseal bone gap of 7 cm with bowing of ulna (Figure 8).

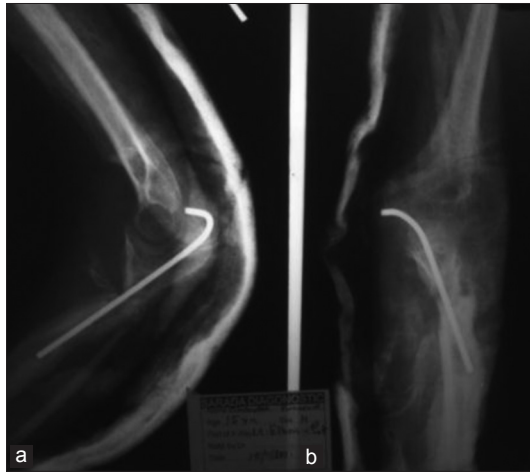


Figure 4: (a and b) 3 month follow up

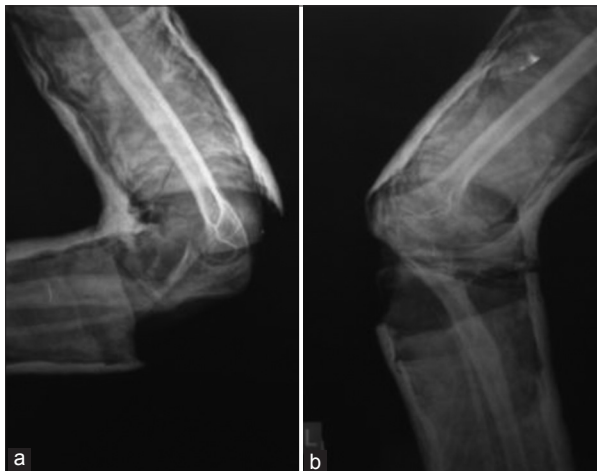


Figure 5: (a and b) 6 month follow up

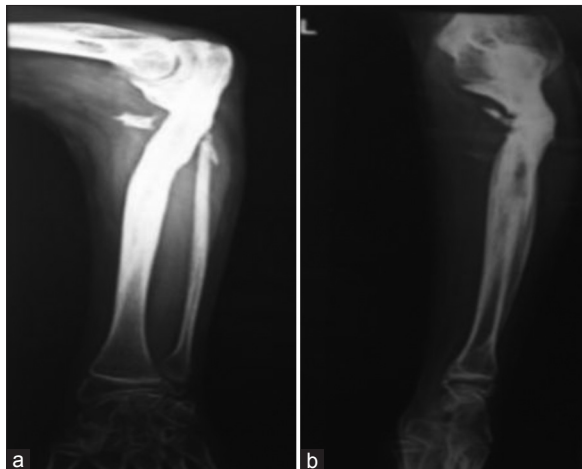


Figure 6: (a and b) 18 month follow up

Operation was done to reconstruct a single bone forearm. Proximal ulna was fused with distal radius & fixed with one intramedullary K-wire. After stitch removal limb was immobilized in long arm plaster cast with elbow in 90 degree flexion, forearm in neutral rotation for eight wks. When radioulnar union was obvious clinicoradiologically, patient was allowed to do vigorous elbow exercises and regular follow up has been done. K-wire was removed after eight months (Figures 9 and 10).

Finally we achieved painless, stable forearm without any unsightly deformity with ROM of 0-135 degree of elbow flexion with forearm fixed in mid prone position (Figure 11).

CASE THREE

A 5 yr old girl presented with pain, inability to take food with her right hand, inability to lift an object with her right hand and progressive deformity for last two years following an incident of trauma and acute osteomyelitis of right forearm bones. On examination, there was anterolateral bowing of forearm, wasting of muscles, ROM-20-80 degree of flexion of elbow, 0-20 degree supination, no pronation with normal shoulder and wrist movements and unstable elbow. X-ray showed chronic osteomyelitis of ulnar shaft with bone gap, proximal radioulnar joint dislocation with proximal migration of radial head (Figure 12).

Operative steps were almost similar to the previous case with proximal radius excised, proximal ulna fixed with remaining part of radius with one intramedullary TENS nail with incorporation of corticancellous bone graft (Figure 13). At 4 month follow up, radioulnar nonunion was suspected (Figures 14 and 15). So, TENS nail was removed, freshening of fracture ends was done and radius fixed with ulna with semi tubular plate and screws (Figure 16). After stitch removal limb was immobilized in a plaster cast for 3 months with elbow in 90 degree flexion, forearm in neutral rotation. With regular follow up, radioulnar union was still not evident clinicoradiologically and definite gap was visible in X-ray (Figure 17). This time autogenous bone marrow was given at non union site and finally union was achieved (Figure 18).

Finally, the girl has painless stable elbow and forearm with no unsightly deformity. ROM of elbow remains at 20-140 degree flexion, fixed in 40 degree supination. Most importantly the girl can take her food with her own hand, and can do her day to day activities without any significant restriction (Figure 19).



Figure 7: (a-d) Postop clinical photographs of case-1 at 18 months showing satisfactory elbow motions and forearm fixed in 20 degree supination



Figure 8: (a and b) Preoperative X-ray of case-2 showing gap non-union of radius



Figure 10: (a and b) 15 months follow up

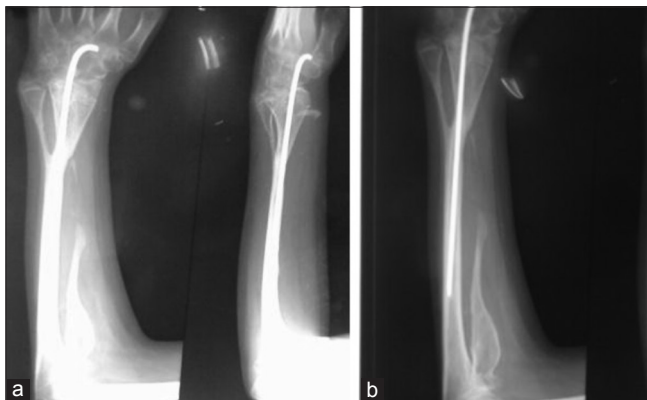


Figure 9: (a and b) Post operative X-ray of case-2 at 3



Figure 11: (a and b) Post op clinical photographs of case 2 at 15 months follow up showing satisfactory elbow motion and forearm is fixed in midprone position

DISCUSSION & SUMMARY

Deficiency of a segment of radius or ulna causes deformity especially in children due to relative growth discrepancy between the two bones. Partial absence of ulna causes dislocation of radiocapitellar joint with subsequent manus varus deformity whereas the same in radius produces

dislocation of distal radioulnar joint and manus valgus deformity.⁵ The extent of such deformities depends on various factors namely age of onset, cause, preliminary treatment among others.

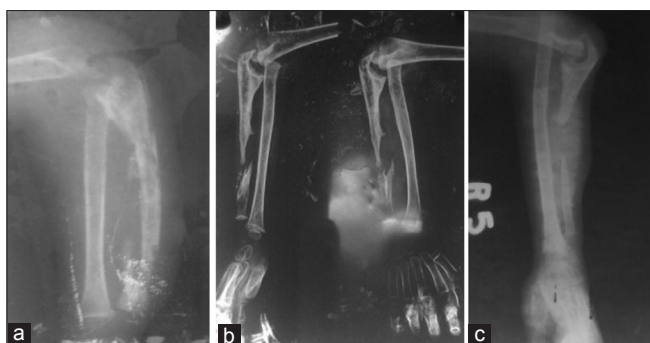


Figure 12: (a-c) Preoperative radiographs of case 3



Figure 13: (a and b) immediate postoperative radiograph of Case 3

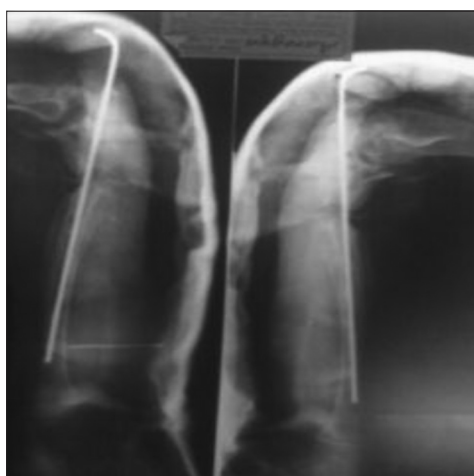


Figure 14: 3 month followup

Among the pathological conditions causing unequal growth of the radius and ulna are congenital absence of part of the radius and ulna, osteomyelitis with sequestration of the diaphysis of one or both bone, benign bone tumours and injury. Congenital defects in the radius and ulna are variable in amount and are often associated with deformities in the hand or other parts of the body. Each case must be considered individually and careful selection is necessary before operation is advised.



Figure 15: 4 month follow

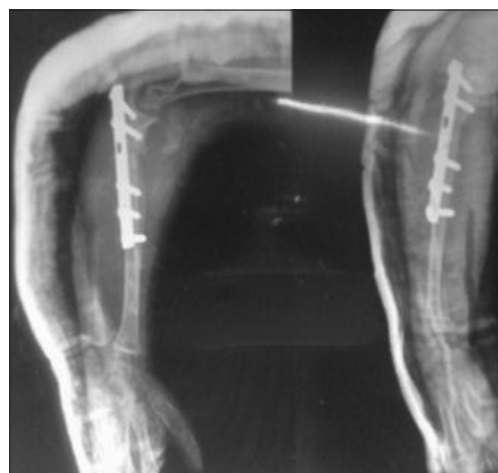


Figure 16: Plate fixation



Figure 17: 7 month followup (nonunion)

The choice of treatment of a gap defect in a forearm bone lies between a replacement graft and radio-ulnar fusion to provide a single bone forearm.^{6,7}

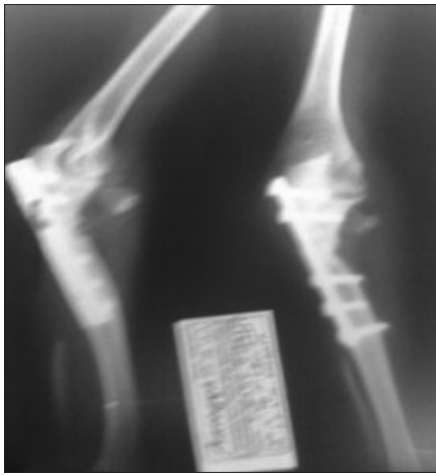


Figure 18: Union after bonemarrow inj

Segmental diaphyseal defect with viable ends can be still managed by autogenous bone grafting or bone graft substitutes with fixation but wide deficiencies with atrophic ends and concurrent infection is a clinical dilemma.

Single bone forearm reconstruction may be a satisfactory clinical option in such cases. Loss of forearm rotations is compensated by shoulder movements with better grip strength and retention of shoulder and wrist movements. The requirement for radio-ulnar transposition are intact radio-carpal and humero-ulnar joints.^{8,9}

The growth discrepancy is not of much concern once continuity is established and further axial growth produces satisfactory cosmetic and functional outcome.

The operation of radioulnar transposition was devised by Hey Grooves(1921) of Bristol. Greenwood (1932),⁶ Watson Jones (1934),⁵ Vitale(1952)⁷ reported a few cases with good cosmetic and functional results. M N Rasool et al reported twelve cases of pyogenic osteomyelitis of forearm bones, treated with single bone forearm & had good outcomes.⁴

CONCLUSION

In this study, three patients were studied. Among them two patients were suffering from chronic osteomyelitis and one was having neglected Monteggia fracture. Single bone forearm reconstruction was done in all three cases. Intramedullary fixation was done in all three cases.¹⁰ Non union occurred in one case which was managed by plate fixation and bone marrow injection at fracture site. We achieved stable forearm with satisfactory range of movement, good hand function and without any unsightly deformity in all three cases.



Figure 19: (a-f) Post op clinical photographs of case 3 at 17 months follow up showing forearm fixed at 40 degree supination; can put hand to mouth for feeding

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An Unusual Case of Gemination in Mandibular Supernumerary Tooth: A Case Report

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Abstract

Gemination or Schizodontism, a relatively uncommon dental anomaly, is characterized by a tooth with a bifid crown and a common root and root canal. It is commonly seen in primary dentition and gemination in a supernumerary tooth is a rare phenomenon. The purpose of this paper is to present an unusual case wherein gemination has occurred in a lingually placed mandibular supernumerary third premolar tooth or “geminated-premolar-like”.

Keywords: Fusion, Gemination, Mandibular Third Premolar, Supernumerary Teeth

INTRODUCTION

Occasionally clinicians encounter developmental anomalies affecting the number of teeth or its morphology. Supernumerary tooth is one among them affecting the number of teeth, regardless of their location they are defined as teeth that exceed the normal dental formula.¹

Supernumerary teeth are the most common cause of dental anomalies, and their prevalence in the permanent dentition has been reported to be between 0.1% and 3.8%.² They may be single, multiple, unilateral, or bilateral in their distribution but have a predilection for the premaxilla. Most common supernumerary tooth is mesiodens, placed between maxillary incisors,³ followed by maxillary lateral incisor, maxillary fourth molar and mandibular third premolars, in descending order. Maxillary premolar, maxillary canine and mandible fourth molar are the least common ones.

Gemination is a developmental disturbance of the shape of teeth and is usually recognized as a partial cleavage of a single tooth germ resulting in one root and one pulp space with two partially or totally separated crowns.⁴ It has a greater tendency to occur in the maxillary anterior region.⁵

Though these individual developmental anomalies are a rare entity in itself, a culmination of both anomalies occurring simultaneously is even rarer; here we present an unusual case of gemination in a lingually placed mandibular supernumerary third premolar tooth or “geminated-premolar-like”.

CASE REPORT

A 26-year-old, healthy male patient reported to our clinic with the chief complaint of chronic irritation on right lateral border of tongue associated with a lingually placed premolar tooth and food lodgement in between the complaint tooth. Following a clinical examination, mild crowding in lower arch and a lingually placed supernumerary tooth was noticed between 44 and 45.

A thorough clinical examination confirmed the presence of supernumerary tooth and the entire remaining dentition was normal. The supernumerary tooth resembled that of a second premolar tooth with an extra cusp (Figure 1). Because of the chronic persisting issue of food lodgement and irritation on tongue movements, exodontia of the supernumerary tooth was done under local anesthesia. Extraction of the tooth was uneventful, suture was placed and haemostasis achieved.

The involved teeth had characteristic appearance of Geminated teeth; the mesiodistal diameter of the clinical crown was larger than normal, and from the cuspal tip to the apex of the root a groove of unequal depth divided the tooth into two, unequal parts had different morphology; crowns and roots were significantly developed but smaller in size. The length of the root was normal relative to its crown. The root apex was completely developed (Figure 2a & 2b).

DISCUSSION

Developmental dental disorders can occur due to various reasons; it can be due to the abnormalities in the differentiation of the dental lamina and the tooth germs resulting in anomalies in number, size and shape or due to abnormalities in the formation of the dental hard tissues resulting in the anomalies in structure.⁵⁻⁷

Gemination is defined as an attempt by a single tooth bud to divide, with a resultant formation of either a large tooth with a bifid crown or two completely divided teeth throughout the crown and root.⁸ The frequency

of gemination ranges from 0.01-0.04% in the primary, and 0.05% in the permanent dentition and the bilateral presentation is rare. It is more frequent in primary than in permanent teeth. The characteristic appearance of geminated tooth include; the larger mesiodistal diameter of the clinical crown than normal, and a groove of unequal depth extending from the incisal edge to the apex of the root dividing the tooth into two, usually two unequal parts.⁵ These characteristic features were evident in our extracted supernumerary tooth.

This phenomenon rarely occurs in mandibular second premolar region and can cause the appearance of molar-like premolar. This anomaly known as molarization of premolars have been infrequently described in the dental literature.⁹ If gemination presents with a deep groove, these teeth may be susceptible to caries and periodontal disease.¹⁰

Simultaneous presentation of supernumerary tooth with associated gemination is a rare phenomenon. On literature review, we came across only three reports of geminated supernumerary teeth.¹¹ Liu *et al*¹² in 2007 was first to report the occurrence of gemination in a supernumerary tooth in the mandibular premolar region and proposed a new morphologic class “geminated-premolar-like” for the same. In 2012 Yang¹³ reported a case of a geminated supernumerary tooth with two crowns and one root in the maxillary premolar region. Amber *et al*¹¹ in same year reported a case of geminated supernumerary tooth with trifold crown.

In contrast with gemination, in fusion the crowns are united by enamel and/or dentin, but eventually there are two roots or two canals in a single root. Gemination causes crowding while fusion more often causes ectopic eruption.¹⁴

A practical way of differentiating between fusion and gemination is Mader’s “two tooth” rule may be fused teeth are counted as one and the number of teeth in the dental arch is less then the term fusion is considered. However, when the abnormal tooth is counted as one and the number of teeth in dental arch is normal then it is termed as gemination or is a case of fusion between normal and supernumerary teeth. A diagnostic consideration would be that supernumerary teeth are often slightly aberrant or cone shaped, thus fusion between normal anomalies of supernumerary teeth will show differences in two halves of the joined crown. However, in gemination the two halves of the joined crown are mirror images also, there is a buccolingual groove that extends to the incisal edge.¹⁵ In our case this method again confirmed the gemination of supernumerary tooth.

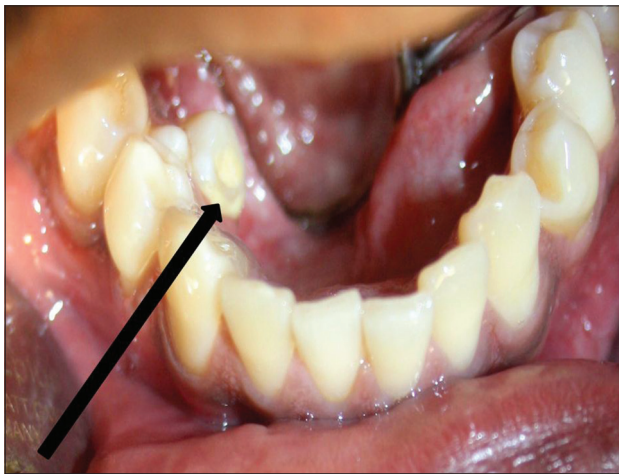


Figure 1: Lingually placed mandibular supernumerary third premolar tooth or “geminated-premolar-like”

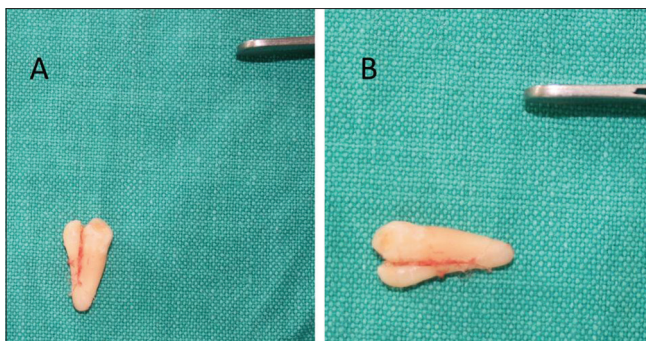


Figure 2: (a and b) Extracted tooth is Mesiodistal and buccolingual view

CONCLUSION

Diagnosis and management of fused or geminated teeth has always been dilemma for the clinicians. Very less number of reported cases in literature can be attributed either due to its rarity or because of their subtle presentation of geminated supernumerary teeth and also due to the limitations of conventional radiography. Therefore more careful examination by clinical and adequate radiographic methods will be helpful in providing early diagnosis and intervention, and also to recognise and report such cases with greater frequency.

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LASER Assisted Excision of Pyogenic Granuloma Associated with Localized Alveolar Bone Loss: A Case Report

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Abstract

Pyogenic granuloma is a primarily reactive hyperplasia which appears in the oral cavity as an overgrowth of tissue due to physical trauma or hormonal factors & irritation. Pyogenic granuloma is a non specific gingival overgrowth seen as a response to underlying irritating factors. The growth is mainly seen in young but it may occur in any age group especially in individuals with poor oral hygiene. Females are far more susceptible than males because of the hormonal changes that occur in women during pregnancy, puberty and menopause. The peak prevalence is in teenagers and young adults, the treatment is excision of the lesion in toto.

Keywords: Granuloma, Gravidarum, Hamartoma, Pyogenic Granuloma, Reactive hyperplasia, Trauma

INTRODUCTION

Pyogenic granuloma was first originally described in 1897 by two French surgeons, Poncet and Dor, who named this lesion botryomycosis hominis. The name for Pyogenic Granuloma is misleading because it is not a true granuloma. In actuality, it is a capillary hemangioma.^{1,2} According to Vilmann et al, majority of the pyogenic granulomas are found on the marginal gingiva with only 15 % of the tumors on the alveolar part. It is reported many times pyogenic granulomas cause significant bone loss.³ Females are far more susceptible than males because of the hormonal changes that occur in women during puberty, pregnancy, and menopause. In many cases, mastication on the lesion causes bleeding and pain and requires surgical intervention before parturition. Some pyogenic granulomas regress after child birth without surgical intervention. Treatment of pyogenic granuloma involves a complete surgical excision. Recurrence of pyogenic granuloma after excision is a known complication but can be prevented. Recurrence rate for pyogenic granuloma is said to be 16 % of the treated lesions and so re excision of such lesions might be necessary. Being a non-neoplastic growth, excisional therapy is the treatment of

choice but some alternative approaches such as cryosurgery, excision by Nd:YAG Laser, flash lamp pulsed dye Laser, injection of corticosteroid or ethanol, and sodium tetradecyl sulphate sclera therapy have been reported to be effective.⁴

So, this case report explains the use of Diode Laser (unilase) for the management of pyogenic granuloma.

CASE REPORT

A 24 years old female patient reported to the department of periodontics, Institute of Dental Sciences Bareilly, with a chief complaint of painless growth of gum in the lower front teeth regionsince 1 year. She also complained of the lesion being associated with bleeding while brushing. The patient was apparently all right when she first noticed the lesion in relation to lingual aspect of lower front teeth region one year back. To start with the lesion was peanut in size and slowly progressed to attain the present size (Figure 1). The patient also noticed loss of contact & presence of spacing between central incisors owing to pressure from this lesion. There was no history of swelling in any other part of the body and had no relevant medical history.

Clinical examination

Extraoral examination

No abnormality detected.

Intraoral examination

Inspection: A solitary discrete gingival over growth was visible between mandibular central incisors on lingual aspect measuring 4×3 mm in size. The growth was roughly oval in shape, colour is varying from pinkish red, and surface was smooth. The growth covered approximately whole of the crown on lingual aspect of mandibular central incisors. The oral hygiene status was found to be poor (Figure 1). Pathologic migration was seen wrt.31,41.

Palpation: The inspectory findings regarding number, site, shape and size were confirmed & the lesion was found to be pedunculated with stalk. The lesion was bleeding on probing.

Radiographic findings: Radiovisiography (RVG) of the involved region demonstrated localized alveolar bone loss suggestive of pressure resorption⁵ (Figure 2).

Blood examination

Revealed normal values.



Figure 1: Preoperative photograph

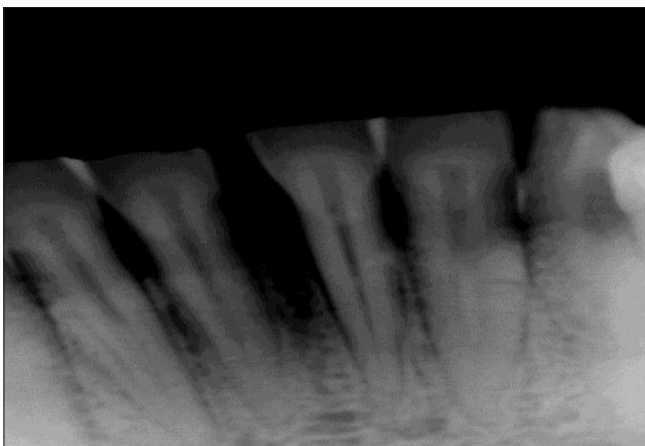


Figure 2: Radiographic picture

HISTOPATHOLOGICAL EXAMINATION

The Hematoxylin & Eosin stained section showed: under scanner view two bits of tissue showed overlying inflamed vascular connective tissue stroma. Low power and high power view showed parakeratinized stratified squamous epithelium with pseudoepitheliomatous hyperplasia in few areas. Stroma also showed plump to spindle shaped fibroblast, with loose to dense collagen fibre bundles suggestive of pyogenic granuloma (Figures 3 and 4).

TREATMENT

The treatment comprised of oral prophylaxis and excisional biopsy of the growth with diode Laser (unilase) 4 Watts. To start with thorough scaling & root planning was carried out & the response to the same was evaluated after 3-4 weeks of time. Then the excisional biopsy of the lesion was done by using diode LASER (unilase-unicorn[®]) 4 watts in toto in the absence of local anaesthesia (Figures 5-7). Following

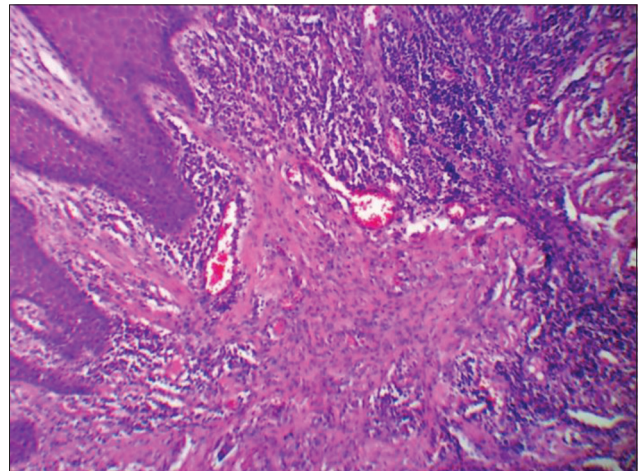


Figure 3: Pyogenic Granuloma 10X Low Power

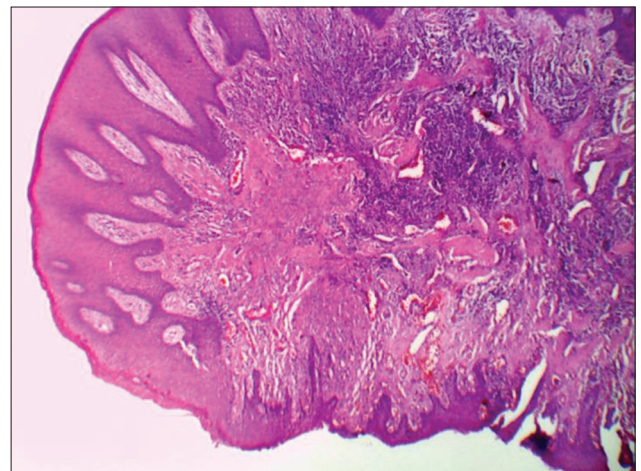


Figure 4: Pyogenic Granuloma 4X Scanner



Figure 5: Local excision with laser



Figure 6: Excised tissue



Figure 7: After excision

excision the surgical site was irrigated with normal saline & covered with periodontal dressing (Coe-Pak[®]). Post-operative instruction were given to the patient along with prescription of amoxicillin 500 mg TID, analgesics 500 mg SOS, chlorhexidine mouth wash, 10 ml twice a day for 10 days is given. The patient was recalled after 1 week, the healing of the lingual site was uneventful & the patient was kept under long term maintenance (Figure 8). After 6 month again the patient was recalled for follow up, the healing was focus to be uneventful & satisfactory without any sign of recurrence (Figure 9).



Figure 8: After 1 week



Figure 9: After 6 months

DISCUSSION

The pyogenic granuloma is a relatively common, tumor like, exuberant tissue response to localized irritation or trauma. Pyogenic granulomas occur at any age, but they most frequently affect young adults. The maxillary gingiva (especially in the anterior region) is involved more frequently than the mandibular gingiva; the facial gingiva is involved more than the lingual gingiva. Three quarters of all oral pyogenic granulomas occur on the gingiva, with the lips, tongue (especially the dorsal surface), and buccal mucosa also affected. A history of trauma is common in extragingival sites, whereas most lesions of the gingiva are response to irritation. Individual's with poor oral hygiene and chronic oral irritants most frequently are affected.^{6,7} Early lesions bleed easily due to extreme vascularity. Pyogenic granulomas can have a rapid growth pattern that can cause alarm. If left alone, a number of pyogenic granulomas undergo fibrous maturation and resemble and/or become fibromas. A number of lesions affect both the facial and lingual gingivae. Pyogenic granulomas usually present as smooth or lobulated

red-to-purple masses that may be either pedunculated or sessile. As lesions mature, the vascularity decreases and the clinical appearance is more collagenous and pink.⁴ Pyogenic granulomas vary in size from a few millimetres to several centimetres and are painless.⁶ These tumors are soft to palpation. A history of trauma is common in extragingival sites, whereas most lesions of the gingiva are a response to irritation. Individuals with poor oral hygiene and chronic oral irritants (eg, over-hanging restorations, calculus) most frequently are affected.

Histologic examination reveals sectioned soft tissue consisting of a lesion composed of ulcerated mucosa covering a core of cellular fibrous connective tissue admixed with proliferating vascular channels and a mixed inflammatory infiltrate. This lesion is a reactive/inflammatory process. Differential diagnosis for PG is fibroma, peripheral ossifying fibroma, irritation fibroma, peripheral giant cell granuloma.

The treatment of choice is conservative surgical excision. For gingival lesions, excising the lesion down to the periosteum and scaling adjacent teeth to remove any calculus and plaque that may be a source of continuing irritation is recommended⁵. Pyogenic granuloma occasionally recurs, and a re-excision is necessary. There recurrence rate is higher for pyogenic granulomas removed during pregnancy. The only outpatient care is observation of the surgical healing 1 week after removal. Prevention consists of routine scaling and home care, especially during pregnancy. No complications are anticipated with removal of this lesion other than the chance of a cosmetic gingival defect. The prognosis is excellent, and the lesion usually does not recur unless inadequately removed. Lesions removed during pregnancy may have a higher recurrence rate.

Focus patient education on better oral hygiene, and consider recommending pulsating mechanical toothbrushes with timers. These tooth brushes encourage better hygiene.¹

Laser therapy using continuous and pulsed CO₂ and Nd:YAG systems have been used for a variety of intraoral soft tissue

lesions such as haemangioma, lymphangioma, squamous papilloma, lichen planus, focal melanosis, and pyogenic granuloma, because they carry the advantage of being less invasive and sutureless procedures that produce only minimal postoperative pain. Rapid healing can be observed within a few days of treatment, and as blood vessels are sealed, there are both a reduced need for post-surgical dressings and improved haemostasis and coagulation. It also depolarizes nerves, thus reducing post-operative pain and also destroys many bacterial and viral colonies that may potentially cause infection. Reduced post-operative discomfort, oedema, scarring and shrinkage have all been associated with its use.⁸

CONCLUSION

Pyogenic granuloma is a reactive hyperplasia/non-specific conditional gingival over growth. Diagnosis should be made with clinical and histopathological findings. Excision by Laser is a successful treatment option for this kind of lesion with no recurrence.

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Plica Neuropathica (Polonica) – A Matter of Faith

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Abstract

Plica neuropathica, also known as plicapolonica, is an uncommon condition in which groups of hair are matted together to form a malodorous, irregularly twisted and irreversibly entangled mass. Predisposing factors include kinky hair, use of shampoos, febrile illness, psychological disturbances, poor hygiene. We report a case of plica neuropathica which was due to personal choice of the patient on account of his religious and spiritual beliefs and therefore any treatment for the same was refused.

Keywords: Neuropathica, Plica, Polonica, Religious

INTRODUCTION

Plica neuropathica is an uncommon condition that presents as a compact mass of scalp hair with irregular twists and irreversibly entangled plaits, which are firm to hard impenetrable masses of keratin cemented together with dirt and exudates.¹ The older name is Plicapolonica since it was prevalent in Poland in the 19th century. Though it is an uncommon condition in the general population, however people belonging to certain religious sects in India encourage this habit due to their religious beliefs. We report one such case of Plica neuropathica which was due to faith and personal choice of the patient.

CASE REPORT

A 67 yr old male was admitted in the surgery department for abdominal wall cellulitis. He was a known diabetic but his sugar levels were under control with oral hypoglycaemics. He also was a known case of chronic obstructive pulmonary disease for which he was taking bronchodilators. His routine investigations at the time of admission were within normal limits. He had itching in his groins for which a dermatology consultation was sought. On examination of the patient it was found out that he had erythematous annular plaques in his groins for which a KOH exam was done; it came out positive for dermatophytosis and appropriate therapy started. On routine examination of the body it was revealed that he had matted, entangled hair with a peculiar odour,

the length of the tangled hair was several feet long which he tightly coiled into a bun under a saffron coloured turban. There was no underlying erythema or scaling and secondary bacterial infection was not present, however few nits were present. On further questioning he declared himself to be an important leader of a religious sect, who had not cut or combed his hair since childhood although he claimed to wash his hair twice a week. He gave no history of use of soap or shampoo. On further prodding he admitted to the use of herbs, camphor, ash to achieve the desired effect.

Since the patient was emphatic that he did not want any treatment for his scalp due to religious reasons, treatment was given only for his fungal infection in his groins.

DISCUSSION

The term “Plica neuropathica” was first used by Le Page in 1884 to describe a case of sudden onset entangled hair in a patient with hysteria.² Le Page attributed this to nerve force while the child’s parents considered it as a visitation from God. Plicapolonica was a common condition of the scalp hair in Poland in 19th century due to deficient care of the hair. Polish custom of wearing tight fur caps and superstitious belief that a lousy scalp was healthy contributed to increased frequency in Poland.³ The exact etiopathogenesis of plica neuropathica is unknown; vigorous friction, frequent use of harsh shampoos leading to longitudinal splitting and weathering of hair shaft, poor hair care/neglect resulting in

scalp infestations and pyodermas are the reasons postulated.⁴ It has been seen following irritant contact dermatitis of the scalp,⁵ psychological disturbances,¹ following azathioprine induced pancytopenia.⁶ Other factors are use of certain shampoos⁷ and natural kinks in the hair.⁸

The scalp hair has been a prime target of superstitious beliefs all over the world. In India, the first records of plica neuropathica or dreadlocks dates back to 2500 BC with the Hindu deity Shiva and his followers as reported in the Vedic scriptures as “JaTaa” meaning twisted locks of hair. In our culture it is a common religious custom to raise a plica for wish fulfillment or to have divine image in the public. The common superstition is that it cures internal illness and cutting it would bring ill health. It is commonly observed among religious “sadhus” of certain religions who have chronic unkempt hair and as has been suggested,⁸ it could be produced by application of tar, pitch or wax by those people in the mosque with faith in the statutory influence of a plica. In our case also, the patient was using a mixture of herbs, camphor and ash to get the desired effect. Long hair when not combed or cut, entangles together to twisted masses of matted ropes of hair known as dreadlocks just as seen in our patient who had not cut or combed his hair since many years. People with dreadlocks wash their hair frequently contrary to popular belief. Our patient also used to wash his hair twice a week. Treatment of plica neuropathica involves cutting the matted hair; prevention includes hair care measures like regular cleaning of hair with mild cleanser or shampoo, avoiding backcombing.⁴ However our patient did not want any treatment as it was a matter of faith for him. He believed that if hair is knotted, the energy remained within the hair and the body keeping a person strong and healthy and he also believed he would develop supernatural mental and spiritual powers. Dreadlocks are universally symbolic of a spiritualists understanding that vanity and physical appearances are unimportant. So, although plicapolonica is uncommon in general population in India, its prevalence among religious sadhus and sadhvis is relatively high.

CONCLUSIONS

In conclusion, we would like to state that although plica neuropathica is seen usually with some underlying psychological problem or hair care neglect, some cases have a religious and spiritual basis for which treatment is usually denied.



Figure 1: Patient with long, entangled masses of hair



Figure 2: Patient, while standing showing entangled masses of hair longer than him

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Leigh Syndrome: An Unusual Rare Case Report

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Abstract

Leigh syndrome is a rare inherited neurometabolic subacute necrotizing encephalopathy mostly involving brainstem and basal ganglia, seen in the early childhood. It is characterized by progressive loss of mental and movement abilities associated with abnormal muscle tone, weakness, visual loss and respiratory failure. There is no effective treatment for this condition, as such the prognosis of this condition is very bad with death occurring within the first few years of life most commonly due to respiratory failure. Here we present a rare and unique case of Leigh syndrome seen in a 5 year male child.

Keywords: Brainstem, Basal Ganglia, Inherited Neuro-metabolic, Necrotizing Encephalopathy

INTRODUCTION

Leigh syndrome is synonymous with Juvenile subacute necrotizing encephalomyelopathy, Leigh disease, infantile subacute necrotizing encephalomyelopathy, and subacute necrotizing encephalomyelopathy (SNEM). It is a rare inherited neurometabolic disorder that affects the central nervous system. It is named after Archibald Denis Leigh, a British neuropsychiatrist who first described the condition in 1951. It is characterized by progressive loss of mental and movement abilities (psychomotor regression) which typically arises in the first year of life leading to death within a span of several years. Infants with this syndrome have symptoms that include diarrhea, vomiting and dysphagia leading to failure to thrive. Excess lactate may be seen in the urine, cerebrospinal CSF and blood. The muscular system is debilitated throughout the body, as the brain cannot control the contraction of muscles. Hypotonia, dystonia, and ataxia are often seen. Ocular signs include ophthalmoparesis, nystagmus and optic atrophy. Cardiac signs include Hypertrophic cardiomyopathy, ventricular septal defects.¹ Respiratory failure is the most common ultimate cause of death. There are characteristic lesions in the basal ganglia, cerebellum and brainstem, these lesions are often accompanied by demyelination. Leigh syndrome can be caused by mutations in one of over 30 different genes either mitochondrial DNA (mtDNA) or in nuclear DNA (gene SURF1 and some COX assembly factors). There is currently no effective treatment.

CASE REPORT

A five year male child was referred from the pediatric department to the department of ophthalmology to rule out any ocular cause of nystagmus, the informant was the grandmother, she reported unspecific symptoms like attention deficits, decrease in alertness, and history of seizures. The child had a history of second degree consanguineous marriage with an uneventful perinatal history.

On examination the child had delayed developmental milestones, muscular atrophy and dystonia with hypotonia, with Glasgow Coma Scale-6 and afebrile. There was increased tone in the lower limbs. Deep tendon reflexes were exaggerated with bilateral Babinski sign positive. Pupils were dilated and sluggishly reacting to light, funduscopy revealed bilateral optic atrophy, ERG was extinguished, VEP showed reduced amplitude with minimal shift in the latency (Figures 1 and 3). CSF analysis showed significantly raised lactate (9.1 mmol/L), Serum lactate (7.2 mmol/L) and creatinine kinase (347 U/L) levels were abnormally raised. Arterial blood gas analysis indicated metabolic acidosis. MRI showed bilateral, symmetrical abnormal lesions in the basal ganglia and the brain stem, thalamus. The lesions were hyperintense in T2W images.

Supportive therapy in the form of Thiamine infusions and alkali supplementation was given but the condition of the child remained the same for a few weeks and later deteriorated.



Figure 1: Optic atrophy of right eye

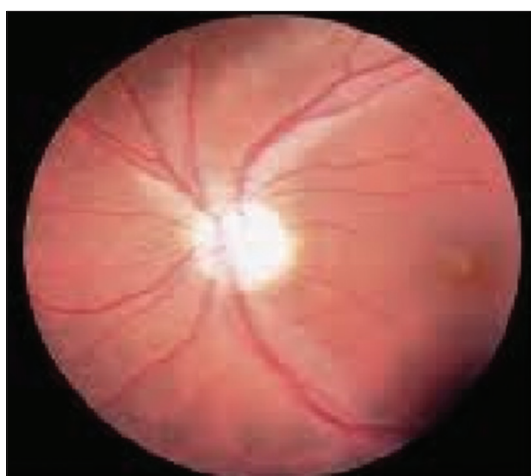


Figure 2: Optic atrophy of left eye

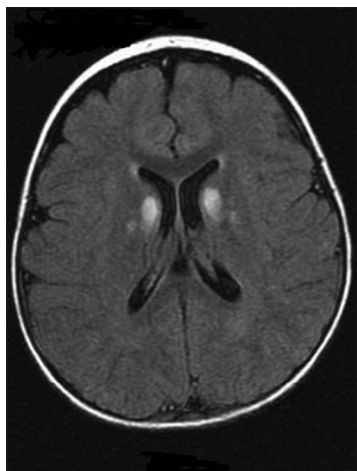


Figure 3: MRI showing bilateral symmetrical lesions in the basal ganglia

DISCUSSION

Leigh syndrome is a rare inherited neurometabolic subacute necrotizing encephalopathy disorder that affects the

central nervous system,¹ occurring in 1 in 40,000 newborns and in certain populations of Saguenay Lac-Saint-Jean region of Quebec, Canada {1 in 2,000 newborns}.² Age of onset of symptoms is usually less than 2 years (infantile form) but others may present in childhood (juvenile form) and unusually in adulthood.³ It presents early in life with psychomotor regression, abnormal muscle tone, weakness, dystonia, brainstem and cerebellar ataxia, visual loss, missed milestones or regression of the achieved milestones, tachypnea, and seizures.⁴ Affected children usually become symptomatic within the first year of life with feeding difficulties, vomiting and failure to thrive. Death usually occurs within a few years after onset of symptoms, typically from progressive respiratory failure.^{5,6} Laboratory analysis shows metabolic acidosis with elevated blood and CSF lactate and pyruvate concentrations.⁷ The diagnostic criteria are: (1) Progressive neurological disease with motor and intellectual developmental delay; (2) Signs and symptoms of brainstem and/or basal ganglia disease; (3) Raised lactate levels in blood and/or cerebrospinal fluid; (4) Characteristic symmetric necrotic lesions in the basal ganglia and/or brainstem.⁸ Neuroimaging^{9,10} plays an important role in diagnosis of patients with Leigh syndrome. The most characteristic neuro-radiological findings are bilateral, symmetric focal hyperintensities in the basal ganglia, thalamus, substantia nigra, and brainstem nuclei at various levels on T2-weighted MRI. In the basal ganglia, the putamen is particularly involved.^{11,12}

Leigh syndrome can be caused by mutations in one of over 30 different genes either mitochondrial DNA (mtDNA) or in nuclear DNA (gene SURF1 and some COX assembly factors).¹ 75 to 80% of Leigh syndrome is caused by mutations in nuclear DNA. Disruption of complex IV, also called cytochrome c oxidase or COX, is the most common cause of Leigh syndrome. The most frequently mutated gene in COX-deficient Leigh syndrome is called SURF1 {located on the long arm of chromosome 9}.¹³ Mutations in either mtDNA or in nuclear encoded genes lead to disorders of oxidative phosphorylation which leads to lack of energy in the cells, which leads to cell death of brain stem and basal ganglia. The most common mitochondrial DNA mutation in Leigh syndrome affects the MT-ATP6 gene.⁴ Another nuclear DNA mutation that causes Leigh syndrome affects the protein complex in the mitochondria, pyruvate dehydrogenase complex (PDHC), an enzyme in the glycolysis pathway, which leads to buildup of pyruvate leading to lactic acidosis, PDHC subunit is encoded by an X-linked gene. This syndrome is most commonly inherited in an autosomal recessive pattern, in about 20 to 25 % of people with Leigh syndrome, the condition is inherited in a mitochondrial pattern, which is also known as maternal inheritance. In a small number of affected individuals with

mutations in nuclear DNA, Leigh syndrome is inherited in an X-linked recessive pattern.

The differential diagnosis include perinatal asphyxia, kernicterus, carbon monoxide poisoning, methanol toxicity, thiamine deficiency, Wilson's disease, biotin-responsive basal ganglia disease and some forms of encephalitis.

There is currently no effective treatment, a high-fat, low-carbohydrate diet may be followed if a gene on the X chromosome is implicated. Thiamine (vitamin B₁) may be given if a deficiency of pyruvate dehydrogenase is known or suspected.¹⁴ Marked improvement was observed with riboflavin, which nearly normalized the adenosine triphosphate production.^{15,16} Rapid clinical and biochemical improvement was observed in patients with acute central respiratory failure with the use of intravenous soya bean oil (ketogenic emulsion).¹⁷ Ketogenic diet has been found to improve the outcome in those with a deficiency of pyruvate dehydrogenase.¹⁸ The symptoms of lactic acidosis are treated by supplementing the diet with sodium bicarbonate or sodium citrate and Dichloroacetate, Coenzyme Q10 and Carnitine supplements have been seen to improve symptoms in some cases. Nucleus transplantation into enucleated oocyte is emerging as a new option for prevention of mitochondrial disorders. Clinical trials of the drug EPI-743 for Leigh disease are ongoing.

CONCLUSION

Since this is a rare condition and since many conditions present with similar symptoms, the diagnosis of Leigh syndrome should be considered in a child with neurological symptoms whose MRI shows bilateral symmetric hyperintense T2w images of the brain stem and basal ganglia (Figure 4). This should prompt further investigations with measurement for blood/CSF lactate and respiratory chain enzyme activities and if appropriate clinical and laboratory settings are available further enzymatic and genetic study must be performed on the parents.

Even though the prognosis of this condition is very bad with death occurring within the first few years of life, with appropriate investigations and accurate diagnosis, adequate supportive therapy can be given adding the extra few years of life to the child.

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Figure 4: Child with Leigh disease having muscular atrophy and rigidity

- Dr. Mallikarjuna, Professor and Head, Department of Radiology.

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Large Pulmonary Embolism - Wind Down The Ambiguity

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Abstract

Pulmonary embolism (PE) accounts for hundreds of hospitalizations annually in our country. The death rate among them is high approximately 15 %. Although D Dimer testing for exclusion of PE and chest computed tomography (CT) for imaging PE have revolutionized the diagnostic approach, in our country where CT scan is either not available in most of the hospital or financially it is beyond reach for many patients. In this study we have diagnosed and managed a moderate sized pulmonary embolism with the help of Electrocardiography, Chest X Ray, D Dimer assay and Echocardiography. In this study, a patient who presented with sign and symptoms which were highly suggestive of Pulmonary embolism and we diagnosed a case of PE with the help of Chest Xray, Electrocardiography, D Dimer assay and Echocardiography. The reason to highlight this study is because in our country, in absence of High frequency multi detector 64 slice CT scan in most of the hospital and financial constrain of we can still diagnose and treat effectively most of the pulmonary embolism.

Keywords: Acute Pulmonary embolism, Large PE, Pulmonary embolism, PE

INTRODUCTION

Pulmonary embolism accounts for millions of hospitalizations annually worldwide. Although D-Dimer testing for exclusion of PE and chest computed tomography (CT), for imaging PE have revolutionized the diagnostic approach, PE remain difficult to detect unless high index of clinical suspicion is kept in management of critically ill patients.

Our understanding of the precipitants of PE has improved especially the role of hyper coagulable states and potentially modifiable risk factors such as long-haul air travel and obesity.

Doctors in critical care and cardiologist must provide expertise in the treatment of hemodynamically compromised patients with PE as well as those with right ventricular failure who maintain a stable blood pressure and heart rate. This requires rapid and accurate risk stratification, often with echocardiography, elevation of troponin, brain natriuretic peptide (BNP) levels, so that

those patient with adverse prognosis will be identified and treated with thrombolysis or embolectomy.^{1,2}

CASE REPORT

An elderly male aged 68 years who came to Narmada trauma centre on 10 March 2013 at 7.40 pm with history of fall from motorcycle, presented with sudden onset breathlessness, restlessness and perspiration. He sustained mild abrasion on face, scalp and bruise on the chest without any major obvious external injury and internal organ injury. There was no evident fracture of hip, femur or spine. He had blunt injury of chest.

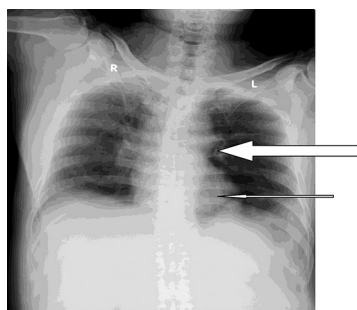
On examination patient was conscious, restless, tachypneic, with respiratory rate of 38/minute, diaphoresis, mild cyanosis with Spo2 of 70 %. His pulse rate was 130 per minute, blood pressure was 90/60 mm hg and was afebrile. He had a drop of blood pressure and saturation (70 systolic with oxygen saturation of 68%).

His investigations were as follows:**Hemogram**

Hemoglobin	11.8 Gm%
Total erythrocyte count	4.08
Erythrocyte sedimentation rate	17 mm/hr
Total leucocyte count	12,300/cumm
Differential leucocyte count	
Neutrophils	81%
Lymphocytes	18%
Monocytes	01%
Eosinophiles	%
Basophiles	%
Platelet count	1.95 Lac/cumm

D Dimer Assay (Elisa) was Positive by Elisa Method**Biochemistry**

RBG	224 mg/dl
Urea	64 mg/dl
Creatinine	1.5 mg/dl
Calcium	9.0 mg/dl
Total Billirubin	0.91
Direct	0.38
Indirect	0.53
AST	50
ALT	40
Total protein	6.8
Albumin	3.6
Globulin	3.2
CK-MB	05
Troponin negative	
Amylase	53
Lipase	80

Chest X-Ray

Chest X ray of patient showing wedge shape opacity (thin arrow) at left base and prominent left pulmonary vascular markings (thick and big arrow) respectively

Electrocardiography

The patient ECG was done in which he had sinus tachycardia with heart rate of 156 per minute, axis was +80 and he had S1Q3T3.

Echocardiography

There was evidence of enlarged right ventricle with size of 3.10 cm, and reduced right ventricular free wall movement. Left ventricle function was normal and there was no regional wall motion abnormality. Pericardium was normal. No evidence of RA/RV/LA/LAA/LV clot, thrombus or vegetation. Valve were normal. There was grade-2 tricuspid regurgitation with peak TR gradient of 45 mm Hg. There was mild pulmonary artery hypertension.

CT Scan

CT scan brain was normal. No abnormalities were detected.

Management

Patient was started on Low molecular weight heparin (Enoxaparin) with a dose of 1 mg/kg body weight twice a day, IV fluids, antibiotic. His oxygen saturation by next 6-8 hours had dropped to 68% and developed hypotension with blood pressure of 80/60 mm Hg. Naso- Trachea intubation was done and patient was put on assisted ventilation CMV-ACMV mode with tidal volume of 6 litres/kg, PEEP of 7-10, respiratory rate of 12/minute, FiO2 of 70 which was subsequently reduced to 30 over next 10-12 hour. He was also started on Dopamine at rate of 15 microdrop/kg per minute and noradrenaline at the rate of 0.1 mg/kg/minute. Low molecular weight heparin was continued for 10 days, during this period patient was on assisted ventilation and inotropic support which were gradually tapered and stopped by tenth day, and ventilator was gradually weaned to pressure support by eighth day and weaned off completely by 9th day. During the second post admission day, patient was started on oral anticoagulation (Warfarin-5 mg once a day) and continued to keep INR between 2-2.5. Patient made complete recovery by 15th day and was discharged on 28 march 2013.

DISCUSSION & CONCLUSION

There are various precipitating factors for venous thrombosis which in turn can cause PE.

A-inherited factors

Hypercoagulable states

1. Mutation in factor v gene (factor v laden)
2. Resistance to activated protein C
3. Prothrombin gene mutation
4. Mutation in protein C gene
5. Protein S deficiency
6. Antithrombin 3 deficiency
7. Hyperhomocysteinemia
8. Antiphospholipid antibody

B-acquired conditions

Acquired conditions may precipitate venous thrombosis

1. Long-haul air travel
2. Surgery/immobilization/trauma
3. Hospitalization with medical illness such as pneumonia or congestive heart failure, stay in medical or surgical intensive care unit.
4. Obesity
5. Increasing age
6. Cigarette smoking
7. Systemic arterial hypertension
8. Diabetes mellitus
9. Use of oral contraceptives/pregnancy/postpartum state
10. Cancer and cancer chemotherapy
11. Stroke/spinal cord injury
12. Indwelling central venous catheter , pacemakers and internal cardiac defibrillators

In critical care and trauma units there is paucity of time for an complete investigational approach in rapidly deteriorating patients where clinical explanation of hemodynamic compromise is not acceptable. A high index of suspicion of pulmonary embolism can resolve the issue in certain patients and lead to a definitive diagnosis of pulmonary embolism. Therapy of pulmonary embolism is tailored according to the patient's clinical presentation, the anatomical extent of the embolous, presence of underlying cardiopulmonary disease, cardiac biomarkers such as troponin, D-Dimer and detection of right side heart dysfunction by physical examination, electrocardiogram and echocardiogram. High risk patients warrant thrombolysis or embolectomy as primary therapy to dissolve or remove the embolous, in addition to anticoagulation to prevent recurrent venous thromboembolism. In low risk patients,

anticoagulation should suffice. The patient in our study had a large embolous; along with positive D-Dimer, ECG changes as sinus tachycardia and S1Q3T3. His chest X ray had prominent pulmonary vascular markings and echocardiography was highly suggestive of pulmonary embolism; with features like enlarged right ventricle, hypokinetic free right ventricular wall and grade-2 tricuspid regurgitation. He was managed by anticoagulation, inotropes and assisted ventilation. Patient made complete recovery and was discharged home with graduated compression stocking for six month.

The important aspect of this study is that we know there are less than 2% of hospital in our country who has in-house multidetector 64 slice latest CT scan (3) which is the gold standard for diagnosis of PE. Therefore it is important for critical care specialist and cardiologist to detect and recognize massive PE so that they can timely investigate aggressively with multidetector CT and manage by thrombolysis or embolectomy/thrombectomy (1). On the other hand we can diagnose mild to moderate grades of pulmonary embolism with the help of D Dimer assay, Echocardiography, Chest X Ray, Electrocardiography, lower limb venous Doppler (5) and in turn manage other grades of PE with Anticoagulation and supportive treatment, without CT scan and thrombolysis effectively as we did in this study and can save a large number of patients who form the majority of ambiguous PE.²⁻⁶

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Dentigerous Cyst Associated with an Erupted Tooth – An Unusual Presentation

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Abstract

Dentigerous cysts are the most common developmental cysts in the jaw region. They are usually associated with the crown of unerupted teeth, odontomas or supernumerary teeth. Dentigerous cysts generally have a chronic, asymptomatic growth phase and are discovered frequently on routine radiographic examination. Occurrence of a dentigerous cyst with an erupted anterior tooth is exceptionally rare and seldom reported in literature. We report an unusual presentation of a dentigerous cyst associated with an erupted mandibular canine. A detailed clinical and radiographic examination augmented its accurate histopathological diagnosis.

Keywords: Cysts, Dental Radiography, Dentigerous Cyst, Mandible, Tooth Eruption

INTRODUCTION

Dentigerous cyst is the most common developmental odontogenic cyst.¹ The exact histogenesis of this cyst remains indefinite, but the most probable etiology is its developmental origin from a tooth follicle.² Dentigerous cysts are almost always associated with the crowns of unerupted teeth and are seen attached to the cemento-enamel junction.³ Less frequently, they can be found in relation with supernumerary teeth,⁴ odontomas⁵ or unerupted deciduous teeth.⁶ Their association with erupted teeth is an extremely rare finding. Herein we report a case of dentigerous cyst associated with an erupted mandibular canine. Detailed clinical and radiographic examination in correlation with the histopathological features aided in diagnosis of this unusual entity.

CASE REPORT

A 55 year old lady presented with a chief complaint of swelling in the right posterior region of the lower jaw since one year. There were no associated complaints of bleeding, discharge, numbness, paresthesia or loose teeth in the same region. The

previous medical and dental history were noncontributory. Extraoral examination revealed a 2 x 3 cm swelling in the right posterior region of the mandible. The overlying skin appeared normal with no evidence of sinus opening or purulent discharge. The intraoral examination showed a diffuse swelling of the same size in 41, 42 & 43 region. The patient was partially edentulous with only 13, 31, 32, 33, 34, 35, 41, 42 and 43 present. The teeth in the region of swelling, 42 and 43 were decayed, with 43 having arrested caries. Based on the above features, radicular cyst, residual cyst, dentigerous cyst, odontogenickercyst and unicysticameloblastoma were considered under provisional diagnosis.

Tooth vitality tests were performed and all the teeth responded positively. These findings ruled out the possibility of Radicular cyst in the same region. A detailed radiographic examination was carried out to determine the extent of the lesion. Orthopantomogram revealed a well-defined multilocular radiolucency in the right body of the mandible extending from 41 to 47 region. The radiolucency had sclerotic borders and extended from alveolar crest to the lower border of the mandible (Figure 1). In addition, the occlusal radiograph displayed expansion of the buccal cortex and perforation in the region of 46 and 47 (Figure 2).

Based on the clinicoradiographic correlation, dentigerous cyst, odontogenickeratocyst and unicysticameloblastoma were considered under differential diagnoses. The cystic lesion was surgically enucleated under general anaesthesia and the surgical specimen was sent for histopathological investigation. The postoperative healing was uneventful with no signs of recurrence.

Gross examination of the cystic specimen demonstrated 3 surgical bits brown in color, firm in consistency, the greatest bit measuring 3.5 x 3 cm attached to 43 at the cemento-enamel junction on the distal aspect (Figure 3). Histopathological examination revealed a cystic lumen lined by 2-3 layered non-keratinized stratified squamous epithelium exhibiting flat to low columnar cells resembling reduced enamel epithelium (Figure 4). Certain areas of superficial epithelium exhibited presence of mucous prosoplasia (Figure 5). The cystic wall exhibited loose fibrous connective tissue, vascular spaces, occasional inflammatory cells, few areas of hemorrhage and abundant cholesterol clefts (Figure 6). Correlating with the clinical and radiographic findings, a diagnosis of Dentigerous cyst associated with right mandibular canine was made.

DISCUSSION

Dentigerous cysts are true developmental cysts which are usually found in association with impacted teeth.³ Their attachment with the cemento-enamel junction of the involved teeth forms the prime basis for their diagnosis. In order of decreasing frequency, they are associated with mandibular third molars, maxillary canines, mandibular second premolars, maxillary third molars, mandibular first premolar, maxillary second premolar and mandibular canine.⁷ Association with an erupted mandibular canine is an extremely rare entity which has been reported here.

Radiographically, three variants of dentigerous cysts namely central, lateral and circumferential have been described. These variants invariably demonstrate a unilocular radiolucency with sclerotic borders surrounding the crown of the tooth but as a rule of thumb, non- eruption or partial eruption of the tooth is considered mandatory for diagnosis of dentigerous cyst. A large dentigerous cyst may appear multilocular radiographically owing to the

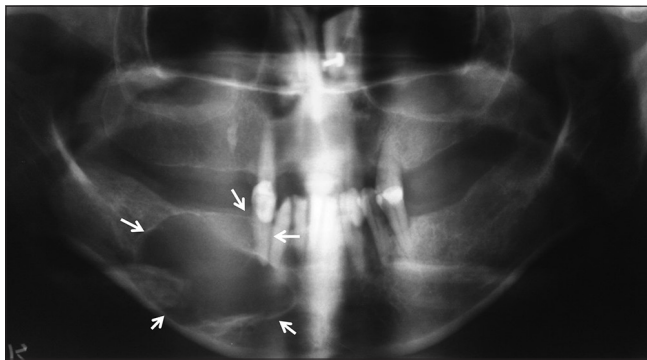


Figure 1: Orthopantomogram revealing a multilocular radiolucency attached to 43 at CEJ



Figure 3: Gross specimen showing cystic tissue attached to the neck of mandibular canine



Figure 2: Occlusal radiograph showing radiolucency with perforation of buccal cortex

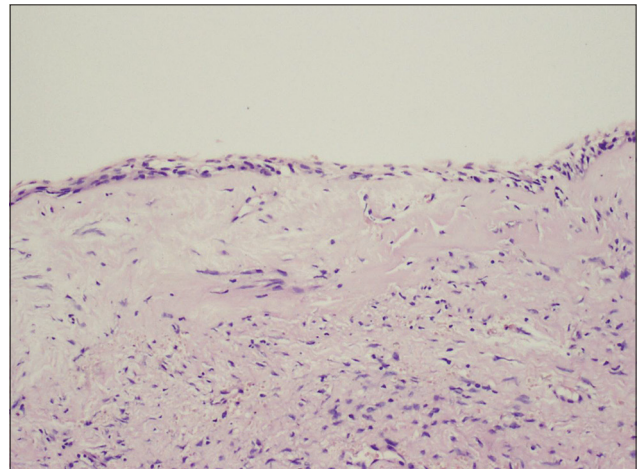


Figure 4: Photomicrograph showing presence of 2-3 layered cystic lining (H& E, 10X)

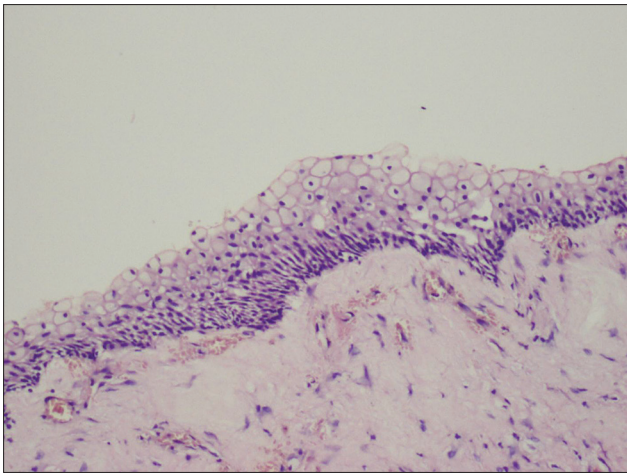


Figure 5: Cystic lining showing mucous producing cells (H& E, 20X)

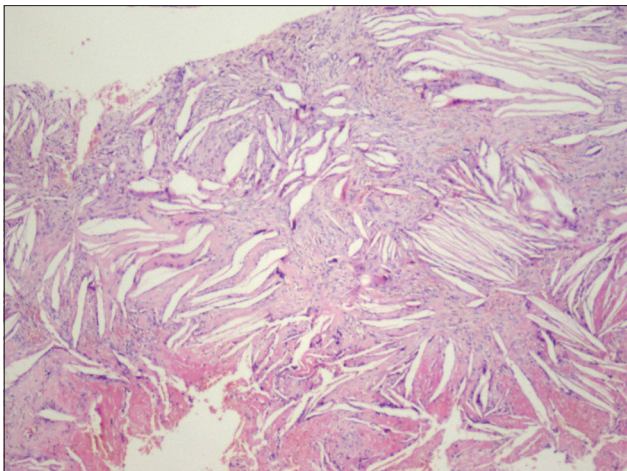


Figure 6: Presence of abundant cholesterol clefts in the cystic wall (H&E, 20X)

persistence of bone trabeculae within the radiolucency.⁸ In our case, the cyst was large, multilocular and associated with the neck of mandibular canine. The growth of the cyst in the present case cyst had occurred predominantly in the apical direction allowing the crown to erupt normally. This demonstrates a novel radiographic variant of lateral type of dentigerous cyst. The above finding is extremely rare.

Histologically, dentigerous cyst classically demonstrates a thin cystic wall comprising of non-keratinized epithelium made up of flattened to low cuboidal or low columnar cells resembling reduced enamel epithelium. Localized proliferation of the cystic wall may occur in the presence of secondary infection.⁸ The cystic wall demonstrates a myxomatous appearance with abundant ground substance and delicate collagen fibers. Nests, islands or strands of odontogenic epithelium may be

evident. In some dentigerous cysts, the epithelial lining may show presence of mucous producing cells as was seen in our case. Additional findings include presence of cholesterol clefts and Rushton bodies in the cystic wall. Abundant cholesterol clefts were found in the cystic wall in our case.

CONCLUSION

The present case demonstrates an extremely rare yet a new variant of lateral dentigerous cyst. Detection of an intrabony lesion in the jaws requires a thorough clinical, radiographic and histopathological workup. Dentigerous cyst usually follows a chronic protracted course and its detection in the presence of carious teeth becomes a challenge to both the surgeons and pathologists. Secondary infection of the developmental lesions masks the typical features which makes the diagnosis even more difficult. Use of various clinical tests and accurate imaging techniques helps the pathologists to appropriately analyze the histopathological picture. Reporting of similar cases in future can increase awareness of this particular entity and help in precise diagnosis and treatment.

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