Dermatological Problems in Geriatric Population

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Prevalence of Dermatological Problems in Indian Geriatric Population

Sajana Krishna, Jacob Thomas, Vinitha Varghese, Gopikrishnan Anjaneyan, Soumya Jagadeesan

ABSTRACT

Background: Aging is a gradual process that results in changes in appearance and functions. These changes are due to both intrinsic factors and extrinsic factors especially UV radiation. Females additionally have their hormonal changes at menopause. It occurs basically at a cellular level and reflects both genetic programme and environmental damage.

Aim: To assess the prevalence of dermatological problems in the geriatric population and effects of external factors on their development.

Methods: A prospective cohort study was carried out on 250 people aged above 65 years who were attending the Dermatology OPD.

Results: The most common symptom was pruritus seen in 177 (70.8%) patients. Xerosis was present in 61.2% of patients. Aging changes included fine wrinkling in 58.4% patients, dyspigmentation in 68%, senile lentigines in 30.4%, senile comedones in 30.4%, sebaceous hyperplasia in 19.6% and idiopathic guttate hypomelanosis in 33.6% of population. The most common systemic diseases found were hypertension(48.4%) and diabetes mellitus.

Conclusion: In our study the commonest geriatric age group was 65-70 years with a male preponderance. Pruritus was the most common complaint present, followed by dryness of skin. Common aging skin changes included xerosis, wrinkling, pigmentary disorders, sebaceous hyperplasia, senile lentigines, senile comedones and IGH. Systematic hypertension was the commonest systemic disease followed by diabetes mellitus in the geriatric population.

Key words: geriatric, dermatoses, ageing, environment.

INTRODUCTION

Aging in the skin is a gradual process that results in changes in appearance and functions. These changes are due to both intrinsic factors and effects of a number of environmental damages. Aging can be biological aging and chronological aging and also has two distinct types called intrinsic and extrinsic aging out of which intrinsic can be caused by cellular senescence whereas extrinsic is caused by external factors like UV rays, smoking and environmental pollutants. Our study therefore deals with the prevalence of dermatological problems related to old age and the statistical association with different environmental insults, drug use and smoking.

METHODS

The study was carried out on 250 patients, aged above 65 years attending the Dermatology OPD from December 2012 to March 2014. A detailed drug history was collected and systemic examination was performed. Skin, hair, nails, oral and genital mucosa was examined. Routine blood and urine investigations and blood sugar were done. Other tests like ESR, LFT, blood urea, serum creatinine, lipid profile, serum electrolytes, thyroid profile, and stool for occult blood were done when required. Dermatological procedures included scrapings and nail clipping for fungal infection, Patch test, skin prick test, skin biopsy, pus for culture and sensitivity. To test the statistical significance of the results Chi-square test was applied. Microsoft excel 2007 was used for the statistical analysis in our study.

Table 1 - showing aging changes in 250 patients.

<table>
<thead>
<tr>
<th>Aging change</th>
<th>No. of patients</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrinkling</td>
<td>146</td>
<td>58.4</td>
</tr>
<tr>
<td>Thinning</td>
<td>136</td>
<td>54.4</td>
</tr>
<tr>
<td>Dyspigmentation</td>
<td>170</td>
<td>68</td>
</tr>
<tr>
<td>Rough thick skin</td>
<td>90.25</td>
<td>36.1</td>
</tr>
<tr>
<td>Deep furrows</td>
<td>87.25</td>
<td>34.9</td>
</tr>
<tr>
<td>Freckles</td>
<td>133</td>
<td>53.2</td>
</tr>
<tr>
<td>Senile lentigines</td>
<td>76</td>
<td>30.4</td>
</tr>
<tr>
<td>Comedones</td>
<td>76</td>
<td>30.4</td>
</tr>
<tr>
<td>Sebaceous hyperplasia</td>
<td>49</td>
<td>19.6</td>
</tr>
<tr>
<td>Senile purpura</td>
<td>66</td>
<td>26.4</td>
</tr>
<tr>
<td>IGH</td>
<td>84</td>
<td>33.6</td>
</tr>
</tbody>
</table>
RESULTS

A total of 250 patients (67.6% males and 36.4% females) of 65-89 years were examined. Maximum number of patients belonged to age group 65-70 years (52.4%), followed by 71-75 years (24.8%). The most common symptom was pruritus complained by 177 (70.8%) patients. Association of pruritus with xerosis, diabetes mellitus, atopy, anaemia, systemic hypertension especially on treatment with ACE inhibitors and diuretics was noted (p < 0.05).

61.2% patients had xerosis which was associated with systemic hypertension especially on ACE inhibitors (p = 0.039) and diuretics (p = 0.006), atopy (p = 0.03) and smoking (p = 0.024).

Aging changes noticed are shown in table 1.

The most common dermatitis was asteatotic eczema (26.8%). Out of 67 patients with asteatotic eczema, 40.3% were atopics (P < 0.001). Twenty-three (41.1%) of them were smokers (P = 0.01). Contact dermatitis was seen in 12% patients, stasis eczema in 6% and seborrhoeic dermatitis in 4.8%.

<table>
<thead>
<tr>
<th>Disease</th>
<th>No. of patients</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatophytosis</td>
<td>41</td>
<td>16.4</td>
</tr>
<tr>
<td>Onychomycosis</td>
<td>41</td>
<td>16.4</td>
</tr>
<tr>
<td>Intertrigo</td>
<td>39</td>
<td>15.6</td>
</tr>
<tr>
<td>Folliculitis</td>
<td>29</td>
<td>11.6</td>
</tr>
<tr>
<td>Mucosal candidiasis</td>
<td>23</td>
<td>9.2</td>
</tr>
<tr>
<td>Warts</td>
<td>18</td>
<td>7.2</td>
</tr>
<tr>
<td>Furunculosis</td>
<td>17</td>
<td>6.8</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2 - showing different skin infections observed.

Different skin infections seen are shown in table 2. In our study, 20(8%) cases of psoriasis (12 males and 8 females) and 13 (5.2%) cases of lichen planus (8 males and 5 females) were seen. There were two cases of oral lichen planus and one case of pustular psoriasis.

Nine(3.6%) cases of Bullous pemphigoid and 7(2.8%) cases of pemphigus vulgaris were seen. There were 23(9.2%) cases of vitiligo and melasma.

Twelve (4.8%) cases of lichen simplex chronicus, 2 cases of delusional parasitosis, one case of prurigo nodularis and dermatitis neglecta were observed.

Seborrhoeic keratosis, acrochordons and cherry angiomases were seen in 42.4%, 34.4% and 32.8% cases respectively.

Premalignant conditions included one case each of Bowens disease and leukoplakia. Malignant conditions were one case each of malignant melanoma, basal cell carcinoma, angiosarcoma, mycosis fungoides and squamous cell carcinoma.

Only 2 cases of lichenoid drug eruption and DRESS syndrome and one case each of TEN and fixed drug eruption were seen during this period.

Xanthelasma was seen in 53 patients (21%) of which 21(36.2%) had dyslipidaemia (p = 0.003).

Fissuring of feet was seen in 62(24.8%) patients of which 36 (31.6%) had diabetes mellitus (P = 0.034). Milia was seen in 12.8%. Out of 22(8.8%) cases of angular cheilitis, 9 (20%) were alcoholics (p = 0.008). In this study, keloid was seen in 1.6% patients.

Of the 14 cases of urticaria, 10 (10.4%) were hypertensives on ACE inhibitors.

Nail changes observed are shown in fig 1.

Subungual hyperkeratosis was seen more in males (20.7%) than females (P value < 0.05). Paronychia...
was seen in 11.2% patients and was more in females (19.8%) as compared to males (7.1%). Fortytwo (73.2%) cases with brittle nails had statistically significant association with smoking (P value < 0.001).

In our study, greying of hair was seen in 94% cases and patterned baldness in 72% cases. Prevalence of patterned baldness was more in males (76.3%) than females (63.3%) (P 0.04). Male pattern baldness was seen in 89.1% of smokers and 70.2% of non-smokers, and this difference is significant (P 0.012).

The most common systemic disease was hypertension in 48.4% of 250 patients, followed by diabetes mellitus (45.6%).

**DISCUSSION**

We tried to find the prevalence of dermatological problems in geriatric population and the possible risk factors in our part of the country. A total of 250 patients were studied. Male: female ratio was 2.08:1 and this male preponderance was observed by others also.1

**Pruritus**

The most common symptom complained by patients was pruritus in 177 (70.8%) patients. In other studies it was 54%, 37%, 39%, 2, 3, 4, 5. In our study, pruritus was associated with xerosis, diabetes mellitus, atopy, anemia, systemic hypertension on angiotensin converting enzyme inhibitors and on diuretics (P < 0.05). But no significant association of pruritus was observed with dyslipidaemia on statins, CLD/CKD or hypothyroidism. Durai et al.6 found pruritus in 49.6% patients, of which 29.8% was associated with xerosis. Association of pruritus with ACE inhibitors was reported in other studies also.7

Association of pruritus with anemia8 and diabetes mellitus9 are reported.

**Discussion on skin changes to aging**

Xerosis was present in 61.2% of our patients. Other studies also showed similar results3, 10, 11. In our study, there was significant association of xerosis with systemic hypertension especially on ACE inhibitors (p 0.039), diuretics (p 0.006), atopy (p 0.03) and smoking (p 0.024). A positive association of xerosis with atopy,12 and diuretic are reported.13 Fine wrinkling and thinning were seen in 58.4 and 54.4% patients which was less compared to observations by Durai and Thappa (100%). While other studies showed wrinkling in 95.5%, 95.6% and 94%. Pigmentary changes were seen in 68% patients in our study though only 13% reported by others. In our study rough thick skin and deep furrows on face was observed in 36.1% and 34.9% which were much higher than prevalence reported by others. This could be attributed to the increased exposure to sun due to lack of knowledge and usage of protective sunscreens in our study population. In our study 53.2% of population had freckles, higher than 4.8% reported by Durai et al. Idiopathic guttate hypomelanosis was seen in 33.6% of population. IGH was more common in males (33.5%) than females (23.5%) (P 0.02). Senile lentigines were found in 30.4% in our study, higher than the 12% reported by Durai and 10% by Grover but lower than 51% found by others. Senile comedones were found in 30.4% of our patients which is higher than reported by other observers.5, 6

Senile purpura was seen in 26.4% in our study while other studies showed 9%, 1%, 11.9%.3, 4, 5.

In our study, there was a statistically significant association of smoking with deep furrows, thick rough skin (P 0.001), IGH (P 0.03) and senile purpura (P 0.049) comparable to findings of Durai16 and Kennedy15. Sebaceous hyperplasia was seen in 19.6% patients in our study while others reported 17% and 1.6%6, 10.

**Dermatitis**

In our study, the most common dermatitis was atopic eczema (26.8%) which was more common in males (33.1%) than females (13.6%) (P 0.02). Other studies had incidence of eczema in 24.2%, 31.2% patients16, 18. Contact dermatitis was seen in 12% patients (M 14.2% F 7.4%). This could be due to increased exposure of men to more allergens. In our study, stasis eczema was seen in 6% and seborrhoeic dermatitis in 4.8% patients. Out of 67 patients with atopic eczema, 27 (40.3%) were atopics (P < 0.001) and 23 (41.1%) were smokers (P 0.01). Lee et al15 postulated that exposure to cigarette smoking may contribute cumulatively to development of atopic dermatitis. Out of 15 cases of stasis eczema, 11 (45.8%) had varicose veins (P 0.001). It was also seen that out of the 69 hypertensives on ACE inhibitors and 41 on diuretics, atopic eczema was present in 27 (40.3%) and 23 (34.3%) patients respectively. Ivanov and Fedotov16 who noticed 24.8% of eczema patients had hypertension emphasized that the detected specificity of eczema in the presence of hypertension indicate a certain relationship between these diseases involving manifest abnormalities in the skin micro circulatory bed.

**Infections**

Intertrigo, onychomycosis and folliculitis were seen more in females (P < 0.05). Patange and Fernandez reported infective dermatoses in 34.5% of the total dermatoses.3 Association of intertrigo and mucosal candidiasis with diabetes mellitus (P < 0.05) was observed in our study, comparable to results by Timshina and Thappa.7 In our study there were 9 cases of pediculosis capitis and 4 cases of scabies (1.6%).

**Papulosqamous disorder:** In our study, 20(8%) cases of psoriasis (12 males and 8 females), 13 cases of lichen planus (8 male and 5 females) two cases of oral lichen planus and one case of pustular psoriasis were seen. Higher prevalence of psoriasis reported in some studies.18
Xanthelasma was seen in 21% patients in our study. This is higher than in other studies -1%, 1.4% . Out of 53 cases of xanthelasma, 21(36.2%) had dyslipidaemia (p0.003) which was comparable to study by Jain et al.19.

Vesiculobullous
Prevalence of immune blistering diseases in our patients was same as in other studies.

Psycho cutaneous disorders
Prevalence of psycho cutaneous disorders were also same as in other places.

Benign tumor
Prevalence of seborheic keratosis (40-50%), acrochordons (30-50%), cherry angiomas (30-60%) was almost similar in our study and other studies.

Premalignant and malignant conditions
Prevalence of premalignant and malignant skin conditions were very low. The lower prevalence of skin tumours in our region could be due to type IV and V skin types.

Disorders of pigmentation
Prevalence of vitiligo was 92%. Others observed 8% and 19%. One study showed 1.57% prevalence. Our prevalence of melasma was 9%, while in other studies it was 5% and 2.4%. Melasma was more common in females (23.5%) than males (2.4%)(P0.001).

Adverse drug reactions
Incidence was very low in this part of the world.

Miscellaneous dermatological conditions
Fissuring of feet was seen in 24 – 62% patients in our study and in other studies. Out of 62 cases with fissuring feet 31.6% were diabetics(p 0.034). Oe M et al found superficial fissures on feet in 9% of diabetic patients.

In our study, milia was seen in 15.6%. Others reported 2.2% ,2%18,20.Acanthosis nigricans was seen in 38 patients (females 26%, males 10%)(p0.002). Female preponderance is observed in other studies21. Melanocytic nevi was seen in 13% in our study, as compared to 27% by Grover2, 32% Patange and 46.3% by Beauregard.

In our study of total 22(9%) cases of angular chelitis, 9(20%) were alcoholics (P 0.008). Other studies reported 5 and 2.9% prevalence22,23. Rifkind have24 reported an association between angular chelitis and alcoholism similar to our study. We found that out of the 14 cases of urticaria, 10(10.4%) were hypertensives on ACE inhibitors. A similar association was reported in other studies. Keloids were seen in 1.6% patients comparable to reports by Lio YH25. In our study macular amyloidosis was seen in 1.6% patients whereas Grover found in 3.5%.

Nail changes
In our study, most common nail changes included loss of lustre (70.8%), cuticle loss (57.6%), brittleness (50.4%) and longitudinal ridging (47.6%). Other studies also showed similar results.

Paronychia was seen in 19.8% females and 7.1% males. Female preponderance reported by others also is29 possibly due to frequent contact with water and detergents. 41(73%) cases with brittle nails had significant association with smoking (P0.001). Similar associations were reported by Gequelim27.

Of the 20 psoriasis patients 11(55%) had nail pitting (P <0.001) and 9(45%) had subungual hyperkeratosis (P 0.001).

Hair changes
In our study, graying was seen in 94% cases and patterned baldness in 72% cases. Patterned baldness was seen more in males(76.3%) than females (63%) (P0.04). In our study, prevalence of patterned baldness in male was 89% in smokers and 70.2% non smokers and this difference is statistically significant (P 0.012). These results were comparable to other studies28.

The most common systemic disease was hypertension in 48.4% followed by diabetes mellitus (45.6%). Hypertension was detected in 40%,27% and 31.5% in other studies while diabetes mellitus was observed in 29.5% and 18% in other studies.

CONCLUSION
In our study the maximum number of geriatric patients belonged to 65-70 years of age with a male preponderance. Hypertension was the most common systemic disease followed by diabetes mellitus in the geriatric population. Pruritus was the most common presenting complaint followed by dryness of skin. Common aging associated skin changes included xerosis, wrinkling, dyspigmentation, sebaceous hyperplasia, senile lentigines, senile comedones and IGH. Smoking was a significant risk factor for aging changes like deep furrows, thick rough skin, senile purpura and IGH. Most common dermatitis was asthetatic eczema. Most common infections included dermatophytosis, onychomycosis, intertrigo followed by folliculitis, mucosal candidiasis, warts, furunculosis and cellulitis. Most common benign tumour was seborheic keratosis. This study showed a significant association between fissure feet and diabetes, angular chelitis and alcoholism and xanthelasma and dyslipidemia. Most common nail changes included loss of luster, cuticle loss, brittleness and longitudinal ridging. Smoking was found to be a risk factor for developing brittle nails among elderly. Common hair changes included graying and patterned alopecia. Male pattern alopecia was significantly associated with smoking. As there is proportional increase in the geriatric population, it is imperative for the clinician to have a better understanding of the prevalence.
and pathophysiology of geriatric skin disorders and their specific management, which differ from that of adult population. Hence more epidemiologic studies concerning dermatologic problems in the geriatric population are needed to help them age gracefully and to live the process of senescence with dignity.

REFERENCES

Percentage Comparison and Evaluation of Curve of Spee and Overbite Among Class II division 1 and Class I Malocclusion Group

Ruby Raj*, Namitha Ramesh**, Krishnan K V*, Sapna Varma N K*

ABSTRACT

Background: Exaggerated curve of Spee is frequently observed in dental malocclusions with deep overbites. Such excessive curve of Spee alters the muscle imbalance, ultimately leading to the improper functional occlusion. It has been proposed that an imbalance between the anterior and the posterior components of occlusal force can cause the lower incisors to overerupt, the premolars to infraerupt, and the lower molars to be mesially inclined.

Objectives: To compare percentage difference in the depth of curve of Spee and overbite between Class I and Class II division 1 malocclusion group. The influence of gender was also investigated.

Method: 100 diagnostic casts of untreated subjects 50 males and 50 females aged 18-25 years were selected from Department of Orthodontics and Dentofacial Orthopaedics. The samples were further divided into 4 groups and the depth of curve of Spee and overbite was measured with a vernier caliper.

Results: There was a 60% increase in curve of Spee in Class II div 1 than Class I group and a 44% increase in overbite in Class II division 1 than Class I group. The mean value of curve of Spee and overbite was increased in class II division 1 group. There was no difference between genders within all the groups.

Conclusion: The curve of Spee and the overbite was greater in Class II division 1 malocclusion group than Class I malocclusion group. There was no difference between genders within all the groups.

Keywords: Curve of Spee, Class I malocclusion, Class II division 1 malocclusion, Overbite.

INTRODUCTION

Occlusal curvature is a naturally occurring phenomenon in the human dentition. The curve of Spee had been first described by Ferdinand Graf von Spee in 1890. He found a line of occlusion in the fossils of mammals and humans. He used skulls with abraded teeth to define a line of occlusion. This line lies on a cylinder that was tangent to the anterior border of the condyle, the occlusal surface of the second molar and the incisal edges of the mandibular incisors. Spee was located at the center of this cylinder in the mid orbital plane so that it had a radius of 6.5 to 7.0 cm.

It had been suggested that the curve of Spee has a biomechanical function during food processing by increasing the crush-shear ratio between the posterior teeth and the efficiency of occlusal forces during mastication. Recently, the curve of Spee and leveling of this curve has been related to incisor overbite, lower arch circumference, lower incisor proclination, and craniofacial morphology. A deep curve of Spee was usually associated with an increased overbite. And therefore the orthodontic correction of the overbite, referer to as deep overbite often involves leveling the curve of Spee by anterior intrusion, posterior extrusion or a combination of these actions. Lower incisor proclination had been used in some cases to decrease the relative vertical overlap of the lower incisors by the upper incisors.

Leveling of the curve of Spee was a routine procedure in orthodontic practice. Clinicians have been concerned for some time with the degree of reduction in arch circumference that accompanies leveling because this could lead to incisor protrusion. On the other hand, Andrews mentioned that there was a natural tendency for deepening of the Curve of Spee with time because the lower jaw’s downward and forward growth was faster and longer than that of the upper jaw. This causes the lower anteriors which are confined by the upper anteriors and lips to be forced back and up, resulting in crowded lower anteriors and or a deeper overbite and deeper Curve of Spee.

Previous studies suggested that the Curve of Spee might be related to the position and inclination of the upper and lower incisors and the overbite. Therefore, the determination of this relationship might be useful to assess the feasibility of leveling the Curve of Spee by orthodontic therapy.

The primary aim of this study was to find the percentage increase of curve of Spee and overbite among Class I and Class II division 1 malocclusion group and the secondary aim was to compare the different depths of Curve of Spee in class I malocclusion and Class II division 1 malocclusion group and also to compare the overbite among the same groups and to assess whether it can be of use as a diagnostic parameter in evaluating prognosis.
Materials and methods

Pretreatment study casts of 100 subjects based on the inclusion criteria were selected. The sample consisted of subjects of Class I malocclusion (male = 25 and female = 25) and subjects of Class II division 1 malocclusion (male = 25 and female = 25).

The inclusion criteria included subjects with full complement of teeth with all teeth in occlusion up to second molar with an age range of 18-25 years and had no history of orthodontic treatment. The crowding was quantified using Little’s Irregularity Index\(^1\). This was done by using a digital vernier caliper. The Little’s irregularity index had been used as scoring method of incisor crowding and this involves measurement of linear displacement (labio -lingually) of anatomic contact points of each mandibular incisor from the adjacent tooth. In this study mild crowding cases (Little’s Irregularity Index =0-6mm) were accepted. The exclusion criteria included subjects with gross crowding(Little’s Irregularity Index=6-10mm), anterior or lateral cross bites, cast restorations or cuspal coverages, rotations and craniofacial disorders like cleft palate.

Measurement of curve of Spee on study cast

The depth of curve of Spee was measured as the perpendicular distance between the deepest cusp tip and a flat plane that was laid on the top of the mandibular dental cast, touching the incisal edges of the central incisors and the distal cusp tips of the most posterior teeth in the lower arch. The measurement was made on both the right and left side of the dental arch and the mean value of these two measurements was used as the depth of curve of Spee\(^1\) (Figure 1).

Measurement of overbite

The overbite was measured as the vertical distance (in millimeters) between the incisal edges of the maxillary central incisor and the incisal edge of the mandibular central incisor\(^1\).

RESULTS

The results stated that there was a 60% increase in curve of Spee in Class II division 1 than Class I malocclusion group and a 44% increase in overbite in Class II division 1 than Class I malocclusion group. The mean value for depth of curve of Spee was more in class II division 1 malocclusion groups when compared to class I malocclusion group. There was no significant difference among males and females of the same group. The mean depth of curve of Spee and overbite is given below.

<table>
<thead>
<tr>
<th>Groups</th>
<th>No of tributaries 3</th>
<th>Mean ± SD</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>1.58 ± 0.24</td>
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<td>0.001***</td>
</tr>
<tr>
<td>Class II div 1</td>
<td>2.01 ± 0.50</td>
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<td>Females</td>
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<tr>
<td>Class I</td>
<td>1.71 ± 0.28</td>
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<td>0.001***</td>
</tr>
<tr>
<td>Class II div 1</td>
<td>2.02 ± 0.37</td>
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</tr>
</tbody>
</table>

Table 1: Intraobserver comparison of mean ± SD of values of curve of Spee

P-value: NS > 0.05: nonsignificant; * < 0.05: significant; ** < 0.01: moderately significant; *** < 0.001: highly significant.

Comparison of overbite

<table>
<thead>
<tr>
<th>Groups</th>
<th>No of tributaries 3</th>
<th>Mean ± SD</th>
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<tr>
<td>Males</td>
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</tr>
<tr>
<td>Class II div 1</td>
<td>2.01 ± 0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>1.71 ± 0.28</td>
<td></td>
<td>0.001***</td>
</tr>
<tr>
<td>Class II div 1</td>
<td>2.02 ± 0.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Intraobserver comparison of mean ± SD of values of overbite

P-value: NS > 0.05: nonsignificant; * < 0.05: significant; ** < 0.01: moderately significant; *** < 0.001: highly significant.
Data was analysed using IBM SPSS Statistics\textsuperscript{20}. Descriptive statistics including mean and standard deviation values were calculated for all variables. To test the statistical significance in the difference in mean value of curve of Spee between class I and class II division 1 for males and females students t test had been applied depending upon distribution of values of variables. To test the statistical significance in the mean value of overbite Mann–Whitney Test had been applied. The percentage increase of curve of Spee among class I and class II division 1 malocclusion group had been analysed using Fisher’s Exact Test and the percentage increase of overbites among class I and class II division 1 malocclusion group had been analysed using Chi-square Test.

### Table 3: Percentage difference of curve of Spee among Class I and Class II division 1 malocclusion group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Curve of Spee</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal n (%)</td>
<td>Above normal n (%)</td>
</tr>
<tr>
<td>Class I</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Class II division 1</td>
<td>41</td>
<td>9</td>
</tr>
</tbody>
</table>

P value = 0.001: highly significant***

### Table 4: Percentile difference of overbite among Class I and Class II division 1 malocclusion group

<table>
<thead>
<tr>
<th>Groups</th>
<th>Curve of Spee</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal n (%)</td>
<td>Above normal n (%)</td>
</tr>
<tr>
<td>Class I</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>Class II division 1</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

P value = 0.001: highly significant***

### DISCUSSION

In this study, attempt was made to separate the sample according to gender, type of malocclusion and in an age range of (18-25 years) to evaluate the variables more precisely. The measurement of curve of Spee was done and the average of the distance on right and left side was taken as the depth of curve of Spee\textsuperscript{14}. Subjects were taken who had the age range between 18-25 years to exclude any growth effects since the depth remained constant during adulthood as compared to flat curve in deciduous and maximum deepening in adolescent dentition. Marshall et al\textsuperscript{15} and Farella et al\textsuperscript{6} also mentioned that the homogenous dental wear could be the reason for the maintenance of curve of Spee in adulthood.

The results obtained in this study indicated that there were no significant differences in any of the variables between two genders for both groups. These results were similar to that of studies conducted by Braun and Schmidt\textsuperscript{16}. They had compared non-growing white males and females with class I and class II division 1 malocclusion and had reported that the depth of the curve of Spee was the same for men and women based on the contact points between the mandibular teeth taken from lateral cephalometric radiographs. Cartor and McNamara\textsuperscript{17} reported that there was no difference in the overbite and curve of Spee between males and females when measured from pretreatment study models. HuiXu\textsuperscript{18} et al also stated that there was no significant difference in curve of Spee between Japanese men and women.

As expected, subjects with class II division 1 had
There was a 60% increase in curve of Spee in Class II group. The males and females of class II division 1 group had larger mean values than males and females of class I group and also there was a significant difference in the curve of Spee among the class I and class II division 1 group.

Usually a deep curve of Spee was associated with an increased over-bite. Bernstein et al 20 showed that orthodontic correction of the class II division 1 cases often involves leveling the curve of Spee either by anterior intrusion, posterior extrusion or a combination. This indicates that the curve of Spee was more deeper in class II division 1 samples than class I occlusion sample. Also, Shannon and Nanda 21 showed that the class II division 1 occlusions had significantly deeper curve of Spee measurement than did class I occlusion. Our findings were greatly differed from that Braun and Schmidt 16 who reported that the curve of Spee was found to be identical for class I and class II occlusions. The variation in depth of curve of Spee has influence in overbite relation. An increase in curve of Spee was seen in deep bite cases and a decrease/negative Spee was seen in open bite cases 22. Therefore an increased Spee was a common feature of patients undergoing orthodontic treatment, hence the evaluation of the depth of curve of Spee was an critical point in treatment planning. Apart from previous studies, the uniqueness of this study is that it reflects a percentage prevalence of curve of Spee and overbite among class II division 1 and class I malocclusion groups.

CONCLUSION

- There was a 60% increase in curve of Spee in Class II division 1 than Class I malocclusion group.
- The mean value of depth of curve of Spee was larger in class II division 1 malocclusion group than class I group.
- There was no significant differences in the curve of Spee between males and females in the same malocclusion group.
- There was no significance in the depth of curve of Spee between the right and left side of the mandibular arch.
- There was a 44% increase in overbite in Class II division 1 than Class I malocclusion group.
- There was a significant increase in overbite in class II division 1 group than class I malocclusion group.
- The variation in depth of curve of Spee influences the overbite.
- There was no significant difference in overbite among males and females in the same malocclusion group.

REFERENCES


Perceptions of Students Towards a Change of Pattern in the Otorhinolaryngology (ENT) Question Paper

Unnikrishnan K Menon*, Joe Joseph**

ABSTRACT

Background: As a precursor to a potential change of pattern of question paper to bring it in alignment with KUHS recommendations, this project was planned to study the perceptions of towards the new pattern. A qualitative study using focus group discussions (FGDs) was considered for this purpose.

Objectives: To study perceptions of students about a changed question paper pattern. Ultimately, to formulate evidence for a change in question paper pattern at the University level.

Method: Voluntary participants from the Third year exam-going batch of students at AIMS, Kochi, were administered a trial examination with the new pattern of question paper, followed by FGDs. The resultant interview data were analysed qualitatively. The faculty were given a feedback questionnaire regarding the question paper.

Results: The students had an overall positive perception towards the new pattern, but with preference for the status quo of two structured essay questions (SEQs), and a willingness to change to the one-mark questions of the new pattern. Reasons for these were clearly elucidated from the emergent themes derived from the FGDs.

Conclusions: Qualitative analysis, via focus group discussions, has proved useful to study student perceptions. The present study has brought to light interesting aspects of students’ motivations for and expectations from a summative theory examination, along with their perceptions towards a new pattern.

INTRODUCTION

Assessment and evaluation are integral aspects of the teaching-learning process. Apart from the obvious use of grading and certification of the learner, assessment helps in feedback for both teacher and learner. It has been shown that assessment techniques can be used to motivate students1. Needless to say, it has a significant role in medical education too. Studies have reported the importance of designing suitable assessment methods in this field2. Written (theory) examination is one method that has stood the test of time. Van der Vleuten has stated that “written examinations are at the ‘heart of the hidden curriculum’”. Medical students, like all other learners, adapt learning methods to suit the examination question patterns. Scouller has compared students’ preparation for multiple choice questions with assignment essays; he found that they are “more likely to employ surface learning approaches in the MCQ examination context and to perceive MCQ examinations as assessing knowledge-based (lower levels of) intellectual processing”3. Despite this, it is disconcerting to note that curriculum-planners and teachers hardly give due importance to how the students feel about these assessment modalities. This is evident in the inadequate literature on this specific topic.

Questionnaires are the most commonly used tools to study response patterns of individuals or groups. However, something as subjective as ‘perceptions’ may not be amenable to objective quantification. Herein lies the relevance of qualitative research, of which focus group discussion (FGD) is one method.

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The present study looks at the perceptions of students about a change in question paper pattern, using FGD as the tool. Ultimately, these perceptions could be used to effect a change in the curriculum via the examination control division (ECD) of the University. The principal researcher is a member of the medical education unit in the Institution.

OBJECTIVES

Primary
To study perceptions of students about a changed question paper pattern.

Secondary
To formulate evidence for a change in question paper pattern at the University level.

REVIEW OF LITERATURE

There is no doubting the fact that students are the biggest stakeholders in any assessment paradigm. Hence, there is a need to understand their attitudes towards the assessment system. An entire literature review of this subject was done by Katrien Struyven, Filip Dochy and Steven Janssens. They mentioned in their concluding remarks that “assessment procedures that are perceived to be ‘inappropriate’ ones tend to encourage surface approaches to learning.” This underlines the need for studies into perceptions of medical students about assessment methods.

Two studies can be quoted in this context. Zeidner, M. (1987) reported a definite preference of students for multiple choice (MCQ) type over Essay type questions4. Birenbaum, M., & Feldman, R. A. (1998) looked at this...
in greater detail and found that good, confident learners chose Essay type over MCQs while poor learners and those low on confidence preferred MCQs over structured essay questions (SEQs). Another study by Lindblom-Ylänne and Lonka K. discusses the “problems that arise in a traditional medical curriculum, particularly concerning traditional assessment practices.” A relevant study from Singapore analysed data obtained via questionnaire and face-to-face interviews to study students’ perception of change in the Singapore education system. It concluded that “the implication for education leaders is that it is important to understand student perception of change because they are the ultimate beneficiary of change.”

Notwithstanding the above, overall, there is a paucity of literature in the specific domain of student perceptions of question paper patterns. The present study has been an effort at correcting this.

Qualitative or quantitative method? That was the next consideration for the study. Creswell in his text about design frameworks, has advised a qualitative approach if the study is done to understand either ‘a new topic or a topic that has never been addressed with a certain group of people’. The present study clearly fell in the latter category. Regarding the use of focus group discussions (FGDs), there is a comprehensive guide to this aspect in a chapter in the ‘Handbook of Mixed Methods in Social and Behavioural Research’.

A recent Indian study has reported the use of FGD to look at student perceptions. Another has used FGDs to study the perceptions of undergraduate MBBS students about a specific posting.

**METHOD**

**Study Design**

Qualitative study using focus group discussion (FGD) was conducted with the students.

**Setting**

This study was conducted in AIMS. The MBBS undergraduate student strength is 100 per batch. Third year (phase III) includes ENT, Ophthalmology and Community Medicine. The final examination (summative assessment) is in January every year.

The existing question paper pattern in the study setting consists of two sections (A & B), each of 20 marks, with one full question of 10 marks (not always SEQ or MEQ type) and 5 short notes of 2 marks each. The new pattern has only 1 ‘full question’ which is an MEQ, followed by 4 more main questions containing short answer questions with differential marking, including a set of four 1-mark questions. The trial paper created consisted of high percentage of clinical questions. The students were being exposed to such a pattern of theory question paper for the first time.

**Participants and Sampling**

The students scheduled to appear for the final examination of third year in January, 2016 took part in the study.

Participant recruitment was through purposive sampling, using convenience and homogenous types. The students were informed well in advance of the plan for this study, excluding specific details and purpose. They were informed that it would be a ‘trial examination’, which could be considered as preparation for their summative assessment examination. They were assured that the marks would not be counted or used in any way towards final assessment scores. They were also informed that it was voluntary. Accordingly, a total of seventy-three (73) students offered to participate.

After the trial question paper was administered, care was taken to include variety of levels of performers amongst the students. Undoubtedly, voluntarism was also an important factor. Accordingly, thirty-six (36) participants were finalized. For the groups’ formation, the main aspect considered was to ensure good group dynamics. Hence, the chosen participants were allowed to form the groups, while ensuring not more than ten in each group. Thus, a total of five focus groups (5 FGs) were formed.

**Procedure**

After discussion in the department, and getting permission from the medical college principal and examination control division (ECD), the project proposal was placed before the ethics committee for approval. Ethics clearance was obtained from the Institutional Ethics Committee.

The focus group discussion module was created with the guidance of faculty from community medicine department, conversant with this method. Specific theory question paper, as per the new pattern, was set, with an accent on more clinical (application-type) questions. The participating students were taken into confidence, regarding the trial paper, and the need for their participation in a group discussion. Informed consent was taken for the latter. The trial question paper was administered to the study population as a ‘mock exam’, about two weeks before their scheduled model examination. At the end of the examination, the study purpose was introduced by the PI.

Another faculty (Head of Dept. of Public Health Dentistry in the same Institution) was identified, who had undergone training in qualitative research. He was inducted as the co-moderator, after briefly explaining about the study.

Over the next few days, the FGDs were conducted in the appropriate method. The time and venue were chosen to suit the participants’ convenience, ensuring no disruption of academic or clinical work. Written informed consent was obtained from participants after explaining the purpose and process of the study. Following introductions, the moderator informed the guidelines of conduct of the discussion. Stress was placed on the need for free flowing discussion, avoiding
direct communication with the moderator. A semi structured discussion guide was prepared with predefined themes. Each theme was introduced by the moderator and the group was encouraged to discuss freely about the same. These themes helped to maintain continuity and an element of uniformity between groups. The time limit was set at approximately one hour. All the themes were quite well covered within this time. An assistant contributed to making sociograms; two for each FGD, one for themes 1 and 2, and another for the remaining four. Active overall participation was ensured. The moderator maintained handwritten field notes of relevant quotes as well as non-verbal cues. The co-moderator helped to oversee the preparations (and later for triangulation of analysis). Audio recording of the FGDs was done, using hand-held mikes and recording device, manned by experienced AV staff. The recordings were labelled and saved in a separate hard drive.

<table>
<thead>
<tr>
<th>Overall theme</th>
<th>Information sought</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison</td>
<td>Whether better or worse than previous sessional ENT papers, and/or Ophthalmology and Community Medicine patterns</td>
</tr>
<tr>
<td>Advantages &amp; disadvantages</td>
<td>Aspects that were good and bad about this pattern, in whichever way the students perceived</td>
</tr>
<tr>
<td>Topics coverage</td>
<td>Whether this pattern covered / can potentially cover more topics, as compared to existing pattern</td>
</tr>
<tr>
<td>Time adequacy</td>
<td>Whether this new pattern can be easily completed in two hours</td>
</tr>
<tr>
<td>Self-satisfaction</td>
<td>To get an idea about the sense of satisfaction, in terms of not only obtaining marks, perceived by the students after answering this different pattern</td>
</tr>
<tr>
<td>Suggestions &amp; recommendations</td>
<td>Students’ final feedback about this new pattern, as regards continuation with or without modifications</td>
</tr>
</tbody>
</table>

**Analysis**

Transcription of each FGD was done verbatim, typed into separate Word files. Next, all the transcripts were re-grouped theme-wise. Thus, the five FGD transcripts were redeveloped into six theme transcripts. For content analysis with the predefined themes, a validated method was used. Colour coding was used such that common points in favour or against were highlighted with the same colour. Next, all the coloured (coded) words and text were assembled into a separate Word file and labelled. Thus, a ‘coding tree’ was created. This was refined by cross-checking between the groups (axial coding), to ensure accuracy and conciseness. Patterns and trends relating to the predefined themes, and keeping the research question in mind, were noted and verified. Quotations, which best represented relevant aspects under each theme, were chosen. Tone and nonverbal communication were checked from the field notes. Finally, the emergent themes (inductive analysis) were summarised.

For the purpose of reliability, a copy of the transcripts was assigned to the co-moderator, to apply his coding process. The results were checked for similarities and points of disagreement, if any.

**FINDINGS**

**STUDENT FGDs**

**Theme 1**

Many of the students compared this question paper pattern favourably with its prior counterpart. The main factors cited were “clinical questions” and “to the point”. The points against related to “overly practical/clinical questions”, “only 1 structured essay question (SEQ)” and “compulsory diagram question”.

**Theme 2**

This theme was intended as the mainstay of this study. There were lively discussions and debates amongst individual members in all the FGDs. Most of these related to three aspects of the new pattern, namely:

-Only one structured essay question (SEQ) [Q. I]

Compulsory diagram question [Q. III]

One mark question [Q. V]

With regard to Q. I, nearly half the students were of the opinion that the existing pattern, with 2 SEqs, was better. The SEQs, in the ENT question paper, usually represent a major topic. And, the usual trend is that the latter number less than ten. Hence, the student can ensure a passing score by studying these. Regarding
the question of drawing diagrams, it was interesting to note that there was at least one in each group who detested it. The mental block against being “forced to draw” was evident. Q. V proved to be the ‘twist in the end’, from the point of view of the research question. Although this was a new pattern for them in ENT, they were exposed to it in Ophthalmology, and few other subjects in earlier Phases. A large majority were enthusiastic in their support for this pattern. Whether this stemmed from the very specific questions asked in this paper, needing clear-cut one word or one sentence answers, is a moot point.

Theme 3
A significant majority agreed that this pattern made for good coverage of all topics in ENT.

Theme 4
This theme reached saturation point very quickly. There was hardly any debate; nearly all agreed that the allotted time of two hours was sufficient (as was the case with the existing pattern).

Theme 5
For this theme, the students were specifically asked to consider the satisfaction of not only getting good marks, but also the sense of having answered a different type of question paper. Once again, there was considerable debate, with the more than half of them expressing satisfaction.

Theme 6
In this concluding theme, the students were asked to give their ‘final verdict’, in terms of recommending a change to this pattern, and to make any related suggestions. It was a mixed bag all through the groups. The enthusiastic ones, always willing for change, wholeheartedly endorsed this pattern, and the clinical nature of questions. At the other end of the spectrum, there were the few totally opposed to change, with the most common argument being against only 1 SEQ. Amongst those who supported the pattern change, majority wanted it only for ENT or, at the most, for Ophthalmology.

Summary of emergent themes
- Only 1 SEQ/MEQ: Most of the students were not in favour of this change in the new pattern
- More clinical-oriented questions: Almost equal support and opposition for this type of questions (not necessarily related to the pattern)
- Compulsory diagram question (Q. III): Many were strongly against this question, very few in support
- One mark question (Q. V): Majority of students in support, provided questions suitably well-framed
- Need to change to this pattern: More in favour, very few definitely against

DISCUSSION

The study threw up largely expected results. However, the FGDs helped in understanding student mindsets and perceptions towards examinations and success in them. Specifically, they did not mind a permanent change in the question paper pattern, provided adequate preparation was given in the formative examinations. That was a fair point.

Structured or modified essay questions found favour with most of the students in the study. In the present pattern in ENT, the SEQs represent the ‘safety cushion’ of representing two of the few major topics. The loss of one such cushion expectedly did not find much favour. This opinion was seen amongst students of different achievement levels; not just the ‘good, confident learner’ as noted in the earlier quoted study.8 Here too, the students had a fair point.

It was encouraging to note the level of enthusiasm for the more challenging one-mark questions, with some even recognising its discriminatory potential. The notion of getting a feel of how a doctor has to tackle patients and their problems was appreciated by these students. The finer points such as need for parity with a central University pattern, need for a slightly different study pattern, advantages of differential marking and the lack of suitability of such a pattern in final Phase subjects all emerged from the FGDs.

Possible causes for concern were the student’s style of studying for a summative examination and the level of importance attached to marks as the sole determinant of satisfaction. From the FGDs, it became clear that for many, reading from the textbook, especially the ‘important topics’, in the last month or so prior to the exam, was the preferred mode of preparation. The resultant success in terms of gaining the required marks seemed to be the only desired end-point. And, their views about ‘expected pattern and questions’ were skewed accordingly. The lack of sense of all-round understanding of the subject, especially the applied aspects, does raise questions about the nature of theory examination patterns and questions.

A Singaporean study looked at the students’ perception of computer-based versus pen-and-paper testing, using an online survey. Majority preferred the former, except for MEQs13.

A qualitative study of medical students’ perceptions of teaching was reported in BMJ16.

Another study utilised the students’ perceptions as a tool for explaining the strengths and weaknesses of two new assessment forms in problem-based learning and the learning environment in which they are embedded17.

Literature search did not throw up any study quite the same as the present one. Hence, no direct comparisons can be drawn. Many studies, cited above, are
broadly of the same nature. All of them underline the importance of taking into consideration the perception of students towards the teaching, learning and assessment processes.

CONCLUSIONS

• Qualitative analysis, via focus group discussions, has proved to be a very useful tool to study student perceptions.

• The present study has brought to light interesting aspects of students’ motivations for and expectations from a summative theory examination.

• Preference for the status quo of two SEQs, and a willingness to change to the one-mark questions of the new pattern was perceived.

• Similar studies would be useful to understand students’ and also patients’ perceptions.

Recommendations

• To consider suitable change in the ENT theory paper, including the present 2 modified essay questions (MEQs), with introduction of the one-mark questions of the KUHS pattern.

• One-mark question to be necessarily on application type.

• To ensure adequate questions on clinical aspects.

Limitations

• Only one qualitative method (FGD) was used. Validity and reliability would have been more if mixed methodology used.

• Convenience sampling and voluntary nature of participation could have compromised a truly representative sample.

• Limited experience of research team.

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Comparison of 3% Hypertonic Saline with 20% Mannitol on Water - Electrolyte Balance and Brain Relaxation During Elective Supratentorial Tumour Surgeries

Rakesh Rajagopal, S Gokuldas

ABSTRACT

Background: Hyperosmolar therapy is used for brain relaxation during supratentorial surgeries. Mannitol has been traditionally used to reduce the intracranial pressure. This double blinded randomised control study compared the effectiveness of 3% hypertonic saline and two different doses of 20% mannitol during elective supratentorial tumour surgery as a brain relaxant and also compared the water-electrolyte abnormalities that occurred in these patients.

Methods: Cerebral relaxation and water electrolyte balance after intravenous administration of 3% hypertonic saline [HTS] and 0.5 gm/Kgm and 0.75 gm/Kgm of 20% mannitol were evaluated in 120 adult patients divided into 3 groups.

The estimation of dural tension and cerebral relaxation was assessed immediately after opening the dura. At 0, 30, 60, 120 and 180 minutes and at extubation or 6 hours (whichever was earlier) after study agent infusion, haemodynamic variables, core temperature, ET CO2, pH, lactate, sodium, potassium and osmolarity were recorded.

Results: 120 patients enrolled in the study were divided into 3 groups of forty patients each (HTS group, 0.5M group, 0.75M group). Brain relaxation was significantly better in the HTS group compared with the M groups (p=0.018). Two patients in the HTS group, 4 patients in the 0.75 group and 9 patients in the 0.5 M group required the administration of additional hyperosmotic agents for brain relaxation (P=0.051). Even though mannitol is a known diuretic there was no significant difference in urine output between the 3 groups (average 1231 ml HTS, 1527ml 0.75 M, 1336 ml 0.5 M; P=0.16). Compared with mannitol, HTS caused an increase in serum sodium concentration and a decrease in serum potassium concentration over time (P<0.001) Osmolarity was higher in the HTS group (312.63 +/- 4.829 mOsm/L) and 298.45 +/- 3.471 mOsm/L in 0.5 M group (P<0.001).

Conclusion: In this study, we observed that during elective supratentorial surgeries 1] 3% hypertonic saline was a better brain relaxant than 20% mannitol 2] With 20% mannitol brain relaxation was better with a higher dose than a lower dose. Even though mannitol is a diuretic we did not find any difference in urine output between the groups. Sodium was higher in the HTS group but it was less than the maximum recommended rise of 12 meq/24 hours. Hyperkalemia was found after mannitol administration but it did not rise to dangerous levels.

Key Words: Hypertonic saline, mannitol, supratentorial tumours, osmolarity, electrolyte balance, lactate.

INTRODUCTION

Raised intracranial pressure [ICP] and brain edema reduces cerebral perfusion pressure and cause secondary brain injury. Neuroanaesthetists uses various methods to control ICP and prevent secondary brain injury during surgery. The commonly used pharmacological method is hyperosmolar therapy. The intravenous administration of hyper osmolar agents produces an osmolar gradient, drawing water across the blood brain gradient. This leads to a decrease in interstitial and intracellular volume thereby causing a decrease in ICP and producing brain relaxation. Mannitol has been traditionally used for brain relaxation in neurosurgery. It is associated with adverse effects such as intra vascular volume depletion, hypotension, hemolysis, renal insufficiency, hyperkalemia, rebound rise in ICP and pulmonary edema. In this study we used 0.5 gm/Kgm and 0.75 gm/Kgm of 20% mannitol on two different groups to compare the effects.

HTS was mainly used as a rescue agent for controlling refractory cerebral edema in neuro surgical patients. It produces reduction in ICP without producing a decrease in serum osmolarity or serum sodium. Although hypertonic saline has potential side effects like subdural haemorrhage and central pontine myelinolysis, it has gained renewed interest as an alternative therapy. There are few clinical trials using hypertonic saline for reducing ICP and brain edema. Hypertonic saline is found to be as efficient as mannitol in controlling ICP and reducing the brain bulk intraoperatively. In our study we used 3 ml/Kgm of 3% saline as infusion.

Objective

The primary objective of our study was to find out whether there is any difference in cerebral relaxation when different doses of 20% mannitol and 3% hypertonic saline were used in patients undergoing elective supratentorial tumour surgeries. The secondary objective was to find the acute changes in osmolarity, pH, lactate, serum sodium and potassium values during the period of action of drugs administered.

Methods

This double blinded random controlled study was conducted on patients who underwent elective...
supratentorial tumour surgery at Amrita Institute of Medical Sciences, Kochi, a tertiary care centre in India during the period December 2012 to November 2014. The study was conducted after getting approval from the ethics committee of the hospital. Each patient was explained about the study and informed consent was taken before enrolling to the study group. The study population was randomly divided into three groups who received hyperosmolar therapy during surgery. The three groups were 1) HTS group who received 1 ml of 3% saline, 2) 0.5M group who received 0.5 gm/Kg bodyweight of 20% Mannitol and 3) 0.75M group who had received 0.75gm/kg bodyweight of 20% Mannitol.

Exclusion criteria

We excluded patients below 18 years and over 65 years of age and those with symptoms of raised ICP and low GCS [less than 13]. Patients with serum sodium less than 130 or more than 150 meq/l and patients who received hyperosmolar therapy upto 24 hrs before surgery were also excluded. ASA 4 and 5 patients and patients who had metabolic abnormality that affect the hydro electrolytic balance like diabetes insipidus, syndrome of inappropriate antidiuretic hormone and cerebral salt wasting syndrome were not included in the study.

Anesthetic management

Patients in all the three groups received general anaesthesia. All the patients were induced with intravenous midazolam 2 mg, glycopyrrolate 0.2 mg, fentanyl (2 mcg/kg) and propofol 2mgm/Kgm. Vecuronium 0.1mgm/kgm was the muscle relaxant used for intubation. Arterial blood pressure [ABP] and central venous pressure [CVP] were monitored in addition to standard monitoring. Anaesthetic maintenance included isoflurane [MAC 1] in air - oxygen combined with intravenous infusion of fentanyl at 1-2mcg/kg/hr and atracurium at 0.3-0.6 mg/kg/hr. Patients were kept normocarbic [PaCO2 35 - 40 mm of Hg]. Hemodynamic variables like heart rate and arterial blood pressure were kept within +/- 20% of baseline values. Hypotension was treated using intravenous fluid/blood and/or a vasopressor. Intravenous fluid managed according to urine output, CVP and blood loss. The transfusion of blood was guided by clinical indicators, assessed blood loss and a haemoglobin of less than 10 mg/dl.

Estimation of dural tension and cerebral swelling

Immediately after opening the dura, the degree of brain relaxation was assessed using a 4-point scale of "perfectly relaxed" (1), “satisfactorily relaxed” (2), “firm brain”(3) and “bulging brain”(4). When the surgeons were not satisfied with the degree of brain relaxation another bolus of the study fluid was administered.

The parameters like hemodynamic variables (HR, MAP and CVP), core temperature, ETCO2, PaO2, PaCO2, lactate and pH, serum electrolytes (sodium, potassium) and osmolality [all from ABG] were recorded at 0 minute (i.e. just before the administration of hyperosmotic agent – baseline), 30 minutes, 60 minutes, 120 minutes, 180 minutes and at 6 hours or extubation (whichever was earlier) after study agent infusion.

Statistical analysis

With 95% confidence and 80% power the minimum sample size was computed to be 110 in each group. Due to time constraints and limited availability of patients, we have restricted the sample size to 120 patients with 40 patients in each group.

Percentage of patients with cerebral relaxation characterized as relaxed/ firm in the three groups [0.5M, 0.75 M and HTS] were noted. Mean change with standard deviation in parameters (sodium, potassium, lactate, pH, osmolarity and urine output) were computed in the above three groups.

To test the statistical significance of the difference in percentages of cases– perfectly relaxed/ satisfactorily relaxed/ firm brain/ bulging brain among the above three groups, additional doses of study agent given and urine output among the three groups recorded – Chi-square test was applied. To test the statistical significance of the difference in the mean changes at different periods of time in the parameters (sodium, potassium, lactate, pH and osmolarity) between the three groups, analysis of variance (ANOVA) with Bonferroni correction was applied. In statistics, the Bonferroni correction is a method used to counteract the problem of multiple comparisons. To test the homogeneity of variances, Levene’s test was carried out.

To test the statistical significance of the difference in the mean changes at different periods of time in the parameters (sodium, potassium, lactate, pH and osmolarity) within a group, students T test was applied. The data obtained was processed using IBM SPSS Statistics version 20.0. A P value ≤ 0.05 was required to be statistically significant.

RESULTS

The study was conducted on 120 patients divided into 3 groups. There was no significant difference in the demographic profile between the three groups of patients (Table1). The hemodynamic parameters,
PaCO₂, ETCO₂ and temperature levels were not significantly different between the groups. The brain relaxation scores observed were either satisfactorily relaxed or firm brain in all the groups. There was no perfectly relaxed or bulging brain observed in any of the three groups. The relaxed/ firm brain observed in the HTS group was 32 and 8 patients respectively, whereas in the 0.75M group it was 27 and 13 and 0.5 M it was 20 each respectively(Table 2). Brain relaxation was significantly better in the HTS group compared with the M groups (p=0.018). Two patients in the HTS group, 4 patients in the 0.75M group and 9 patients in 0.5 M group required the administration of additional hyperosmotic agents for brain relaxation (P=0.051)( Table 2). Even though mannitol is a known diuretic there was no significant difference in urine output between the 3 groups (average1231 ml HTS, 1527 ml 0.75 M, 1336 ml 0.5M; P=0.16) (Table 2). Compared with mannitol, HTS caused an increase in serum sodium concentration and a decrease in serum potassium concentration over time (P<0.001, Figures. 2, 3). Serum potassium levels were found to increase with mannitol administration and decrease with hypertonic saline. Osmolarity was higher in the HTS group (312.63 +/- 4.823 mOsm/L) when compared with the 0.75 M group (305.25 +/- 4.289 mOsm/L) and 0.5 M group (298.45 +/- 3.471 mOsm/L, (P<0.001) [Figure 1]. In our study there was statistically significant change in lactate levels in both mannitol group and hypertonic saline group over time. When compared with each other statistically significant changes were observed at 120 minutes, 180 minutes and 6 hours after administering the respective hyperosmotic agent [Figure 4]. There were no significant differences in pH levels between the 3 groups (Table 3)[figure 5].

<table>
<thead>
<tr>
<th>0.5 g/kg Mannitol</th>
<th>0.75 g/kg Mannitol</th>
<th>3% Hypertonic saline</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>46.80 +/-12.17</td>
<td>46.55 +/-12.704</td>
<td>46.00 +/- 13.278</td>
</tr>
<tr>
<td>Male/ Females</td>
<td>22/18</td>
<td>25/15</td>
<td>22/18</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.5 +/- 8.3113</td>
<td>63.05 +/-8.1868</td>
<td>62.4 +/- 7.5644</td>
</tr>
</tbody>
</table>

Table 1: Patient Characteristics.

<table>
<thead>
<tr>
<th>0.5 g/kg Mannitol</th>
<th>0.75 g/kg Mannitol</th>
<th>3% Hypertonic saline</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral relaxation Relaxed/ firm</td>
<td>20/20</td>
<td>27/13</td>
<td>32/8</td>
</tr>
<tr>
<td>Additional Agent requirement</td>
<td>9/31</td>
<td>4/36</td>
<td>2/38</td>
</tr>
<tr>
<td>Urine output</td>
<td>1336.25+/-635.58</td>
<td>1527.5 +/-813.89</td>
<td>1231.25 +/-627.43</td>
</tr>
</tbody>
</table>

Table 2: Cerebral Relaxation and Urine output

<table>
<thead>
<tr>
<th>0.5 g/kg Mannitol</th>
<th>0.75 g/kg Mannitol</th>
<th>3% Hypertonic saline</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmolarity</td>
<td>298.45 +/- 3.471</td>
<td>305.25 +/- 4.289</td>
<td>312.63 +/- 4.823</td>
</tr>
<tr>
<td>Sodium</td>
<td>134.88 +/- 2.483</td>
<td>130.95 +/-1.811</td>
<td>144.43 +/- 3.029</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.153 +/-0.2112</td>
<td>4.200 +/-0.2230</td>
<td>3.723 +/-0.2567</td>
</tr>
<tr>
<td>Lactate</td>
<td>1.555 +/-0.3351</td>
<td>2.043 +/- 0.6437</td>
<td>1.675 +/-0.3815</td>
</tr>
<tr>
<td>pH</td>
<td>7.4115 +/- 0.0408</td>
<td>7.4072 +/-0.02864</td>
<td>7.4160 +/-0.05138</td>
</tr>
</tbody>
</table>

Table 3: Arterial blood gas parameters at 30 minutes post infusion of study agent.
fig 1: Variations in osmolarity among the three groups over a period of time.

fig 2: Variations in serum sodium among the three groups over a period of time.

fig 3: Variations in potassium among the three groups over a period of time.
DISCUSSION

Osmotically active agents are used to reduce the intracranial pressure and cerebral edema in neurosurgical patients. In our study, patients who received 3% HTS were found to have a better relaxed brain (80%) than the patients who received mannitol (0.75 M-67.5% 0.5 M 50%). The studies of Wu et al9 and Dostal et al11 also showed similar results. We observed an increase in osmolarity 30 minutes after the administration of HTS infusion (312.63 mOsm/L). This is significantly higher than the osmolarity in mannitol groups (0.75 M-305.25 mOsm/L, 0.5 M-298.45 mOsm/L).

Hypertonic saline has a higher osmotic reflection coefficient than mannitol (1.0 and 0.9 respectively). This result in a lower solute leakage with HTS and a rise in serum osmolarity9. The higher osmotic gradient increases brain water extraction into the intravascular space and produces better brain relaxation with hypertonic saline compared to mannitol. Among the mannitol groups the 0.75M group has recorded better cerebral relaxation (67.5% vs. 50% respectively) and higher rise in serum osmolarity (305.25 mOsm/L vs. 298.45 mOsm/L respectively) when compared with 0.5 M group. Higher doses of mannitol result in a dose-related increase in serum osmolarity and a corresponding decrease in brain water content leading to better brain relaxation13. The study of Quentin et al12 also showed similar results.

Patients in HTS group recorded a rise in serum sodium levels (144.43 mmol/L), 30 minutes after administration of the intravenous agent where as the mannitol

![Fig 4: Variations in lactate among the three groups over a period of time.](image-url)

![Fig 5: Variations in pH among the three groups over a period of time.](image-url)
groups showed a decrease in serum sodium level (130.95 mmol/L in 0.75 M and 134.88 mmol/L in 0.5 M). The rise in sodium in the HTS group may be due to the decreased solute leak. Hypernatremia stimulates the release of antidiuretic hormone which increases the reabsorption of water from the distal convoluted and collecting tubules of kidneys, leading to a decrease in urine output. Mannitol administration results in an initial increase in osmolarity with fluid shift towards the intra vascular compartment producing dilutional hyponatremia. Similar observations were seen in the studies of Wu et al, Rozet et al and Gemma et al.

In this study potassium levels were increased in M groups and decreased in HTS group. Hyperkalemia after high doses of mannitol administration has been reported, but the exact mechanism of this phenomenon is unknown. The probable causes are 1) potassium efflux from intra cellular fluid as a result of hyperosmolar condition. 2) crenation and hemolysis of RBCs and 3) dilution of extra cellular fluid with a decrease in bicarbonate leading to metabolic acidosis. HTS infusion produces hyperchloremic acidosis. The development of hypokalemia with HTS is a compensatory mechanism to maintain electrical neutrality.

Studies of Wu et al and Rozet et al showed an increase in lactate levels when mannitol was used and no change with hypertonic saline. In this study there was statistically significant change in lactate levels observed at 120 minutes, 180 minutes and 6 hours after administration of the respective hyperosmolar agent. The negative fluid balance induced by mannitol stimulation of release of antidiuretic hormone which increases the reabsorption of water from the distal convoluted and collecting tubules of kidneys, leading to a decrease in urine output. Mannitol administration results in an initial increase in osmolarity with fluid shift towards the intra vascular compartment producing dilutional hyponatremia. Similar observations were seen in the studies of Wu et al, Rozet et al and Gemma et al.

The negative fluid balance induced by mannitol stimulation of release of antidiuretic hormone which increases the reabsorption of water from the distal convoluted and collecting tubules of kidneys, leading to a decrease in urine output. Mannitol administration results in an initial increase in osmolarity with fluid shift towards the intra vascular compartment producing dilutional hyponatremia. Similar observations were seen in the studies of Wu et al, Rozet et al and Gemma et al.

There were few limitations to this study. The major limitation was the 4-point scale assessment of brain relaxation. This is a subjective assessment and the additional dose requirement is based on this. Pre-operative factors that might affect brain relaxation like the size of the tumour, peritumoral edema, midline shift, the position of the head and body were not included in the study. Patients with symptoms and signs of raised intracranial pressure were excluded but it may be possible to have some patients with altered intracranial compliance. The values of electrolytes, lactate, pH and osmolality were taken from ABG values which may be slightly different from serum values.

CONCLUSION

The study showed 3% HTS provided better brain relaxation than 20% mannitol during elective supratentorial tumour surgeries. The administration of 3% hypertonic saline resulted in higher sodium and osmolality levels than 20% mannitol. Among the mannitol groups better brain relaxation was obtained with 0.75 M than 0.5 M group. Though mannitol is a diuretic we could not find any statistically significant difference in urine output between the groups. Potassium was significantly high in the mannitol groups compared to hypertonic saline group. Though serum lactate was significantly high in all the groups over a period of time there was no significant change in pH.

This study shows 3% hypertonic saline is better than mannitol for supra tentorial surgeries in reducing brain edema. If mannitol is being used it is better to use 0.75 gms/Kgm of 20% mannitol as it provided better brain relaxation than 0.5 gm/Kgm of 20% mannitol.

This study looked only the immediate effects of both agents but not any sequelae and other factors affecting neurological outcome in the patient groups.

REFERENCES


8. Toung TJ, Hurn PD, Traystman RJ, Bharadwaj A. Global brain...


Factors Determining Immediate Mortality In Hospitalised Patients Suffering Cardiopulmonary Arrest – Observations From A Tertiary Care Center


ABSTRACT
Each year, cardiac arrest claims more than 3.7 million lives worldwide. Burden of cardiac arrests on developing countries are unknown due to limited data recorded and lack of major studies.

Objective: Evaluation of the significance of intra-arrest parameters in determining immediate mortality for hospitalized patients suffering cardio-pulmonary arrest.

Method of Study: Prospective cross-sectional study of adult patients undergoing active resuscitation following a cardiac arrest episode in our hospital was taken. Out of hospital arrests and arrests in individuals with age<18years was not taken into account. Data was collected by ‘code blue’ teams and ICU duty doctors. Statistical analysis was done to estimate mortality and to identify pre-arrest factors of mortality.

Results: Of the total 140cases, there were 76 (54.28%) males and 64 (45.72%) females. Mean age was 57.6 ± 13.5 years; 52.14% were in < 60 years group while >60 years had 45.72%. ICU admissions were 41.43%, 15% were in ER and procedure rooms, 20% in monitored rooms & rest in general ward beds. Analysis showed significant mortality in General wards & ICU. Common presenting rhythm in our study was asystole 42.86% followed by PEA 35%. Asystole rhythm had 71.7% mortality, while VT/VF had 100% survival. The mean resuscitation duration was 24.4 ± 13.5minutes and resuscitation for >20minutes was found to have 62.8% mortality. Our study had 47.86% arrests during day time shifts while night shifts had 52.14% arrests, 50.7% mortality present for cardiac arrests during night time.

Conclusion: Immediate mortality following cardiac arrest for hospitalized patients was 35%. The independent factors responsible for immediate mortality were: Age >60years, Time of cardiac arrest and PEA as presenting rhythm.

Key Words: Cardiopulmonary arrest, Hospitalized patients, Mortality factors.

INTRODUCTION
Cardiopulmonary resuscitation (CPR) is widely practiced since the clinical use of closed chest massage was first reported in 19601. Each year, cardiac arrest claims more than 424,000 lives in the United States, 300,000 lives in Europe, and upwards of 3.7 million lives worldwide2. Geographically there is a great imbalance in the statistical figures available about the burden of cardiac arrest on a global scale; practically almost all published literature about this condition is from the developed world.

Studies from the 1990s have noted hospital CPR discharge rates ranging from 13 to 14%3. Studies of CPR among hospitalized patients revealed survival to discharge ranging from 6% in cancer patients in the USA to as high as 43% in monitored bed patients in Sweden4. Using data from 14, 720 in-hospital cardiac arrests in the national registry of cardiopulmonary resuscitation (NRCPR), Peberdy et al5. reported overall survival to hospital discharge rate of 17%. Recently Nadkarni et al6 analyzed years of NRCPR data and compared the survival outcomes in adults after cardiac arrest using survival to discharge rate as primary outcome, they found a survival rate of 18% for adults after pulseless cardiac arrests. Even though there are multiple studies conducted about survival post-resuscitation, there are wide variations regarding the outcomes of those studies regarding role of advanced age, mechanically ventilated patients, and location of arrest in mortality7,8. Multiple reasons are given for these variations, differences in inclusion/exclusion criteria, differences in the setting in which the CPR was performed & problems with definitions of common variables.

Even though outcomes after in-hospital & pre-hospital cardiac arrest resuscitations have been studied well in developed countries, there is only limited data on the outcomes of in-hospital cardiac arrest from countries like India. Differences in resources for utilization & prevalent disease pattern in developing countries are likely to have an impact on the eventual outcome of CPR.10-12 Despite considerably difference in health care delivery pattern & diseases, Indian healthcare system currently rely on data that is overwhelmingly from developed nations. We aim to estimate the pre-arrest factors that account for significant immediate mortality following cardiac arrest in hospitalized patients.
## Table 1: Arrest Variables with Frequencies & Statistical Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency n (%)</th>
<th>Mortality n (%)</th>
<th>P-value</th>
<th>Multivariate Analysis (OR, p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 60 years</td>
<td>72 (51.42)</td>
<td>11 (15.3)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>&gt; 60 years</td>
<td>68 (48.57)</td>
<td>38 (55.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>76 (54.28)</td>
<td>27 (35.5)</td>
<td>0.515</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>64 (45.72)</td>
<td>22 (34.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time of Arrest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day Time</td>
<td>67 (47.86)</td>
<td>12 (17.9)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Night Time</td>
<td>73 (52.14)</td>
<td>37 (50.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Location of Arrest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU</td>
<td>58 (41.43)</td>
<td>29 (50)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>ER &amp; Procedure Room</td>
<td>21 (15)</td>
<td>4 (19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitored Beds</td>
<td>28 (20)</td>
<td>2 (7.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Beds</td>
<td>33 (23.57)</td>
<td>14 (42.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time to Start CPR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 minute</td>
<td>79 (56.43)</td>
<td>33 (41.8)</td>
<td>0.003</td>
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</tr>
<tr>
<td>1-2 minutes</td>
<td>28 (20)</td>
<td>2 (7.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 2 minutes</td>
<td>33 (23.57)</td>
<td>14 (42.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presenting Rhythm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asystole</td>
<td>60 (42.86)</td>
<td>43 (71.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEA</td>
<td>49 (35)</td>
<td>6 (12.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>21 (15)</td>
<td>0 (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VF</td>
<td>10 (7.14)</td>
<td>0 (0)</td>
<td></td>
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</tr>
<tr>
<td><strong>Duration Of CPR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10 minutes</td>
<td>37 (26.42)</td>
<td>0 (0)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>10-20 minutes</td>
<td>25 (17.86)</td>
<td>0 (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 20 minutes</td>
<td>78 (55.72)</td>
<td>49 (62.8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES
To identify significant intra-arrest risk factors causing immediate mortality in hospitalized patients suffering cardio-pulmonary arrest.

METHOD OF STUDY
A prospective cross-sectional study was conducted in our tertiary care hospital which has more than 1000 total beds & 200 acute care beds. The hospital had a ‘Code Blue Team’ for managing cardiac arrests happening outside of acute care settings & procedural rooms. Cardiac arrest was defined as per AHA guidelines; by the absence of a detectable pulse (pulselessness) in an unresponsive patient. Any of such cases was informed to ‘Code Blue Team’ which consists of Anaesthesiologists and Emergency medicine doctors with staff nurses, all of them well trained in 2010 ACLS guidelines by AHA. Inclusion criteria for the study were hospitalized patients who underwent active resuscitation efforts following cardiac arrest; in case of patients having multiple cardiac arrests during current admission, only the first episode was taken into study. The exclusion criteria were: age less than 18yrs, out of hospital cardiac arrests or en-route cardiac arrests treated by Emergency Medical Services (EMS), patients opted for Do Not Resuscitate order (DNR), patients or by-standers who refused to give consent.

Initial assessment was done at the site of arrest, where the team recorded time of arrest, time to start code, presenting rhythm, duration of code. Immediate survival was defined as the restoration of spontaneous circulation (ROSC) for more than 20 min. Percentage of mortality in cardiac arrest cases was computed and tabulated under Immediate Mortality, Mortality within 24 hours and Mortality before discharge. To compare two categorical variables, Chi square test was used to find statistical significance and if any expected cells has < 5 frequencies then Fisher’s Exact Test was applied. For data that follows heterogeneity Mann-Whitney U Test was applied to calculate P-value. P-value of <0.05 was considered to be statistically significant. Statistical analysis was done using IBM SPSS Statistics 20.

<table>
<thead>
<tr>
<th>category</th>
<th>outcome</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mortality</td>
<td>49</td>
<td>62.80</td>
<td>5.236</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Survival</td>
<td>91</td>
<td>54.76</td>
<td>15.661</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Mean hospital stay was higher for the control group.

<table>
<thead>
<tr>
<th>category</th>
<th>outcome</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mortality</td>
<td>49</td>
<td>35.3061</td>
<td>5.89917</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Survival</td>
<td>91</td>
<td>18.5165</td>
<td>12.87061</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Comparison between survival & mortality in General wards & ICU.

RESULTS
Of the 140 individuals in our study group, there were 76 (54.28%) males and 64 (45.72%) females. Youngest patient was 31 years old while the oldest was 89 years. The mean age of the group was found to be 57.6 ± 13.5 years. For the statistical analysis purposes they were divided into two groups of age: < 60 years & > 60 years. 73 (52.14%) people in < 60 years group while the other had 64 (45.72%). Gender was not found to be statistically significant for mortality [Table 1]. On calculation, Mean age for mortality was 62.8 ± 5.23 years and for survival was 54.76 ± 15.66 years. Mann-Whitney U Test was applied to calculate P-value. Mean age was found significant for immediate mortality. [Table 2]

Of the total 140 cases, 41.43% were admitted in ICUs, 15% were in ER and procedure rooms, 20% in monitored rooms & rest in general ward beds [Table 1][Graph 1]. Association showed significant factor for mortality in General wards & ICU.

We looked for variations in mortality for cardiac arrests occurring during day & night duty times. And in our study 47.86% arrests occurred during day time while night shifts had 52.14% arrests. On association, 50.7% mortality was estimated for cardiac arrests during night time and time of arrest was found to be a significant independent factor for immediate mortality.

Time to start resuscitation codes in each of the above admission areas were: < 1 minute in ICUs, ER & procedure rooms 56.43%, 1-2 minutes in monitored single beds 20% & 2-3 minutes in general beds 23.57 [Table 1]. Association showed it as a significant factor for immediate mortality.

The most common presenting rhythm during cardiac arrest was asystole 42.86% followed by PEA 35%; while shockable rhythms VT 15% & VF 7.14% were not seen as frequently as former [Table 1]. Asystole rhythm had 71.7% mortality, while VT & VF had 100%
survival. Presenting rhythm was a significant factor for immediate mortality while PEA as a presenting rhythm was an independent factor for mortality.

The mean resuscitation duration in our study was 24.4 ± 13.5 minutes, while for statistical purposes they were grouped into three categories. [Table 1][Graph 2] Resuscitation for >20 minutes was found to have 62.8% mortality & thus duration of resuscitation was found to be a significant factor for immediate mortality. For mortality mean duration of resuscitation was found to be 35.3 ± 5.9 minutes, while for survival it was 18.5 ± 12.9 minutes [Table 3]. Mean resuscitation duration is a statistically significant predictor for immediate mortality.

Of the total 140 subjects, 49 (35%) didn’t survive resuscitation and had immediate mortality.

- **DISCUSSION**

The incidence of IHCA is not just a measure of the burden of illness; it is also a measure of the institutional response for prevention of IHCA. IHCA outcomes serve as a more refined measure of institutional readiness and effectiveness in the treatment of IHCA. In case of IHCAs, despite the availability of qualified life support immediately, the outcome of IHCA remains poor. Survival to discharge after IHCA rarely exceeds 20% 

and it has remained stable in the last 25 years. Most studies regarding cardiac arrest outcome was focussed only on intra-arrest variables; studies that have considered pre-arrest variables have generally suffered low accuracy and/or incomplete validation.

Age was a statistically significant predictor for immediate mortality in our study. Age group >60 years had 55.9% immediate mortality in comparison to Age <60 years which had 15.3%, these are similar to those described by Schneider AP II et al14. Age has been described as a significant factor for mortality by many studies15 but contradicted in some newer studies16.

Reason for the contradiction can be due to the increase in Do Not Resuscitate orders for those with poor prognosis and elderly patients. In our study 76 males & 64 females were there with respective mortality of 35.5% & 34.4%. We didn’t find gender as a significant factor for immediate outcomes6.

Data showed increased mortality for patients admitted in non-monitored general wards (42.4%) than monitored wards (7.1%). Our immediate mortality for
resuscitations done in Emergency department & procedure rooms was only 19%; this contradicts with the values reported in other studies. The reason those studies reported a huge mortality rate close to 80% may be due to the high incidences of OHCA which were treated on the way to hospital. While some of the newer studies conducted showed similar picture to ours. Our ICU mortality was 50%, presumably due to greater severity of illness in the people admitted there and also may have more multiple co-existing conditions than those admitted in other parts of the hospital. Location of arrest was significant factor on univariate analysis but when other factors were controlled it failed to show as an independent factor for mortality on multivariate analysis.

Mortality was high (50.7%) for cardiac arrests happening during night shifts than during day time (17.9%). Other studies also have shown similar effect on the outcome of cardiac arrest with better survival among patients who experienced cardiac arrest during morning or evening shifts. It is observed that VF/VT as the initial rhythm has a better outcome than PEA/Asystole rhythms; this has been reported in numerous studies. Nadkarni et al reported 23% prevalence of ventricular fibrillation or ventricular tachycardia, and asystole and PEA prevalence of 35% and 32%, respectively and in our study prevalence of 35% and 32%, respectively and in our study we had VT/VF of 22.14%, PEA of 35% & Asystole of 42.86% prevalence in adults. Findings in our study also concur to above reports; 71.7% immediate mortality was seen in patients having asystole. On multivariate analysis, rhythm PEA showed significance for mortality (OR 7.88 [1.49-41.63]).

Our study resuscitation duration more than 20 minutes showed 62.8% immediate mortality and was a significant factor for immediate outcome. Our final model on multivariate analysis failed to show resuscitation duration as an independent factor for mortality. This finding is supported by many other studies also, but a few of them reported the variable to be an independent predictor of outcome as well. Schultz et al found a direct relationship between duration of resuscitation and subsequent mortality. Cooper and Cade reported that the most important factor affecting the survival rate was a resuscitation duration less than 20 minutes. Our data showed a mean duration of resuscitation for mortality as 35.3 ± 5.9 minutes and for survival it was 18.5 ± 12.9 minutes.

CONCLUSION

Immediate mortality following cardiac arrest for hospitalized patients was 35%. The independent factors responsible for immediate mortality were identified by multivariate analysis [Table 10]; the most significant factors according to Odds Ratio were: Age >60 years, Time of cardiac arrest and PEA as presenting rhythm.

Outcome of cardiac resuscitation in this single-tertiary care hospital from a developing country showed a mortality rate comparable to the developed countries.

LIMITATIONS

There were a few limitations to our study which prevent us from extrapolating the results to general population. Sample population in our study was regional in nature and so results may not reflect to the whole population. A prolonged study period could have helped to grasp the trends in the topic and improvement due to interventions. All pre-arrest parameters could not be assessed due to technical reasons and loss of data. Lack of proper post-resuscitation briefings or documentation protocols caused some loss of sample subjects.

REFERENCES

Factors Determining Immediate Mortality In Hospitalized Patients Suffering Cardiopulmonary Arrest – Observations From A Tertiary Care Center


Treatment Outcomes of Bicondylar Tibial Plateau Fractures by Hybrid Fixator and with open Reduction and Internal Fixation

Faizal Ali A A, Mohammed Ashraf

ABSTRACT

Background: High energy bicondylar tibial fractures are conventionally being treated by open reduction and internal fixation (ORIF). There are very few studies comparing the efficacy of ORIF with the relatively new treatment option using hybrid fixator.

Aim: To compare the treatment outcomes of ORIF and hybrid fixator in Schatzker types 5 and 6 of proximal tibial fractures.

Methods: A prospective study was conducted in 20 patients each from both groups. The patients were followed up at 3 months, 6 months and one year postoperatively. Assessment was done using Rasmussen’s WOMAC scores.

Results: The hybrid fixator group had lesser blood loss and hospitalisation compared to the ORIF group which was statistically significant.

Conclusions: Both ORIF and hybrid circular fixator were comparable in terms of functional and anatomical outcomes. The circular fixator seems to be marginally more efficacious in fractures with extensive soft tissue injury.

INTRODUCTION

Tibial condylar fractures are especially challenging to the orthopaedic surgeons because of their number, variety, complexity, different concepts of management and associated injuries. As proximal tibia gives attachment to the various elements of knee stabilizers, alteration of anatomy caused by injury results in functional impairment. Bicondylar fractures are less common among the tibial fractures and are more difficult to treat. The complex fracture and the soft tissue injury result in greater complication rates after open reduction and internal fixation (ORIF). This used to be popular in earlier days, but now more and more reports of successful treatment with external fixation are coming out. Stability is more with internal fixation but there is always the risk of wound breakdown with extensive soft tissue injury.

As the detrimental effects of excessive dissection of the tenuous soft-tissue envelope and devascularisation of the osseous fragments became apparent, a number of alternative methods of treatment have been popularized including percutaneous reduction and circular frame stabilization, minimally invasive techniques and implants, and temporary external fixation followed by delayed definitive surgery. The advantage of circular frame fixation includes minimal soft tissue disruption. Early reports by Stainer et al reported good or excellent results in his cases. Honkonen described poor results when associated with a varus misalignment of greater than 5 degrees, a valgus tilt of more than 10 degrees, articular displacement in excess of 4 mm and more than 10 mm of condylar widening. So, the indications for hybrid external fixation would be Schatzker V and VI tibial plateau fractures, significant metaphyseal comminution with or without diaphyseal extension, soft tissue issues of compartment syndrome, open fractures etc. The disadvantages include the need for constant pin care site and the risk of septic arthritis. This allows early joint mobilization, cartilage regeneration and joint remodelling, which decreases the risk of joint stiffness. The commercially available fixators are expensive and so we have utilized a modified version by using an Ilizarov ring with a monolateral external fixator system.

There are only few direct comparisons of the two operative approaches. Taking all these facts into consideration, a study was carried out to compare the functional outcomes between open reduction with internal fixation and hybrid external fixator in terms of mode of injury, fracture pattern, complications encountered and associated injuries.

Objectives

Primary: To compare the Rasmussen’s score of patients presenting with bicondylar tibial fractures at three months, six months and one year after hybrid external fixation with that of open reduction and internal fixation.

Secondary: To compare the functional outcome of open reduction with internal fixation and hybrid external fixator in tibial bicondylar fractures.

Materials and methods

Study design: A prospective, open labelled parallel group study in which standard open reduction and internal fixation was compared with percutaneous and/or limited open fixation and application of a hybrid fixator for displaced bicondylar tibial plateau fractures (Schatzker types V and VI). Forty patients who...
satisfied the inclusion criteria during the study period from November 2012- November 2013 were included in the study.

Inclusion criteria
The presence of a bicondylar tibial plateau fracture Schatzker type V or VI planned for surgery
Patient’s age over 18 years and the ability to walk without assistance before injury

Exclusion criteria
Polytrauma patients with tibial plateau fractures requiring prolonged ICU care.

Data collection
All cases of tibial plateau fractures presenting to the casualty who satisfied the inclusion criteria were included in the study. Appropriate management of the associated injuries was done by the concerned specialties. Once the patient was stabilised, relevant X-rays were taken (Fig-1, 2). CT scan was taken for all tibial plateau fractures16,17. Patients with compartment syndrome diagnosed clinically underwent emergency fasciotomy followed by the definitive surgery. The decision on the surgical procedure was made on an alternating basis. All the patients who underwent either ORIF or hybrid fixation were observed for the outcome at three, six and twelve months. Patients who underwent ORIF did so with a standard AO buttress plate (Fig- 3). Following internal fixation, patients were mobilised (non-weight bearing) with crutches for 6 weeks. Partial weight bearing was commenced, progressing to full weight bearing by 3 months.

The hybrid fixation was done under spinal or general anaesthesia. The fragments were aligned by simple manual traction. The condylar fragments were compressed with a large tenaculum forceps or a pelvic reduction forceps and fixed with 6.5 mm cannulated screws or the long 3.5-mm screws from the pelvic sets depending on the size of the fragment. Failure to reduce the articular fragments or the presence of articular depression often necessitated an open reduction through a small antero-medial or an antero-lateral approach to elevate the articular surface. Two 1.8-mm wires were introduced in the safe zone, 15 mm from the joint line. The minimal angle in between the two oblique wires was 60 degrees respecting the anatomic constraints. The ring was attached and the wires were tensioned. The meta diaphyseal alignment was corrected, and two Schantz pins were inserted at the diaphysis. The Schantz pins were connected to the external fixator bar, which was then coupled to the ring using the external fixator clamp (Fig- 4, 5). The alignment was again checked under fluoroscopy in both the standard antero-posterior and the lateral planes.

All patients were instructed on fixator care and taught to do daily pin sites cleansing with Povidone Iodine solution. They were started on passive range of motion exercise on the third post operative day and active motion by first week. Non weight bearing was initiated at 6–8 weeks, followed by partial weight bearing ambulation depending on the amount of callus formation. Full weight bearing was given after removal of the fixator. Serial radiographs in AP and lateral planes were...
performed at 3 months, 6 months, and 1 year post operatively.

**Follow up**

Pre-operative, post-operative and most recent radiographs for each patient were analysed to assess the anatomical outcome using Rasmussen’s system of grading (Fig- 6). This rating system evaluated joint depression, condylar widening and varus or valgus angulation. Postoperative reductions with less than 3mm of residual joint depression on anteroposterior or lateral views were considered acceptable. Postoperative reductions with more than 5mm of residual joint depression on anteroposterior or lateral views were rated as poor.

During follow-up, the patients were assessed in terms of range of motion, fracture union clinically and radiologically, any hardware-related complications like wire breakage, clamp failures, surgical site infections, osteomyelitis, and complications related to the surgery like nerve injury from inadvertent pin placement (Figs- 7, 8, 9, 10, 11, 12). Follow-up radiographs were used to detect post-traumatic osteoarthritis. Osteoarthritis was recorded if there was progressive obliteration of joint space, osteophyte formation and subchondral sclerosis at six months or at one year. Functional and anatomical scores according to Rassmussen and the WOMAC (Western Ontario and McMaster Universities) Index of Osteoarthritis were assessed at 3 months, 6 months and 1 year (Tables- 1, 2, 3).

![Fig 4: Hybrid fixator](image4.png)

![Fig 5: Same fracture after hybrid fixator](image5.png)

![Fig 6: Postoperative X-ray at one year after ORIF](image6.png)

![Fig 7: Extension of the knee joint at one year post ORIF](image7.png)

![Fig 8: Flexion post ORIF at one year](image8.png)

![Fig 9: Status post hybrid fixator, follow-up X-Ray at 3 months.](image9.png)
Statistical analysis
Data was analyzed using computer software, Statistical Package for Social Sciences (SPSS) version 16 for Windows. To elucidate the associations and comparisons between different parameters, Chi square ($\chi^2$) test, Student’s t test and Analysis of variance (One Way ANOVA) were used. A two-tailed probability of value, < 0.05 was considered significant.

Outcome of the study
Outcome variables included the clinical complications, functional analysis using Rasmussen’s score and The WOMAC Index of Osteoarthritis.

Ethical issues
Though the proposed study included an invasive procedure, no major ethical issues were expected. The study was cleared by Ethics committee and was intended for publication later on, maintaining the privacy and confidentiality of the study participants.

Conflict of interests if any
There was no additional burden imposed on the patient through this study. There was no financial support for the study from any external agencies. There was no conflict of interests in this study.

Observation and Results
All the patients in the ORIF group had a closed injury compared to 90% of patients from hybrid fixation group (Table- 4). 5% from ORIF group and 15% from hybrid fixator group had soft tissue injury. Comminuted fracture was seen in 85% of ORIF group and 95% of hybrid fixator group. Both groups had displacement in X- Rays in all cases. In ORIF group, there was extension into the shaft in 50% of cases and in hybrid fixator group extension into the shaft was present in 65% of cases. While all patients in the ORIF group had concomitant fibular fracture, only 85% from the hybrid fixator group had fibular fracture. 50% from the ORIF group had type 5 and the rest 50% had a type 6 bicondylar tibial fracture. In the hybrid fixator group it was 30% and 70% respectively. Both group had equal incidence of postoperative complications in the form of infection which was not statistically significant.

The mean duration of hospital stay and the average blood loss were significantly less in the hybrid fixator group (P value less than 0.001) (Table- 5). Duration of hospital stay in days was found to be extremely high for ORIF group nearing two weeks (13.5 days) where as in Hybrid fixator group, it was only one week (6.75 days). Similarly, average blood loss was high with 498.5ml in ORIF group against 222 ml in hybrid group.

At 3 months of follow up, the WOMAC score, which was measured in terms of pain, stiffness, and physical function, showed a mean score of 55.5 against a maximum score of 68. The mean Rasmussen anatomical score was 17.1 for the hybrid group. The mean depression score was 5.5. Condylar widening was 5.8 mm which fall between the good and excellent range.
<table>
<thead>
<tr>
<th>Points</th>
<th>Acceptable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>Good</td>
</tr>
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</table>

### Table 2: Rasmussen’s functional grading

<table>
<thead>
<tr>
<th>Points</th>
<th>Acceptable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>Good</td>
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### Table 3: Rasmussen’s anatomical grading

<table>
<thead>
<tr>
<th>Points</th>
<th>Acceptable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>Good</td>
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### A. Subjective Complaints

<table>
<thead>
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<tbody>
<tr>
<td>No Pain</td>
<td>6</td>
</tr>
<tr>
<td>Occasional ache, Bad weather pain</td>
<td>5</td>
</tr>
<tr>
<td>Stabbing pain in certain position</td>
<td>4</td>
</tr>
<tr>
<td>Afternoon pain, Intense, Constant pain around the knee after activity</td>
<td>2</td>
</tr>
<tr>
<td>Night pain at rest</td>
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</table>

#### b. Walking Capacity

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal walking capacity (in relation to age)</td>
<td>6</td>
</tr>
<tr>
<td>Walking outdoors at least one hour</td>
<td>4</td>
</tr>
<tr>
<td>Short walks outdoors &gt; 15 minutes</td>
<td>2</td>
</tr>
<tr>
<td>Walking indoors only</td>
<td>1</td>
</tr>
<tr>
<td>Wheel chair / Bedridden</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 3: Rasmussen’s anatomical grading

<table>
<thead>
<tr>
<th>Points</th>
<th>Acceptable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>excellent</td>
<td>Good</td>
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</tbody>
</table>

### A. Depression

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>Not Present</td>
<td>6</td>
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<tr>
<td>&lt; 5 mm</td>
<td>4</td>
</tr>
<tr>
<td>6 to 10 mm</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 10 mm</td>
<td>0</td>
</tr>
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</table>

### B. Condylar widening

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>&lt; 5 mm</td>
<td>6</td>
</tr>
<tr>
<td>6 to 10 mm</td>
<td>4</td>
</tr>
<tr>
<td>&gt; 10 mm</td>
<td>2</td>
</tr>
</tbody>
</table>

### C. Angulation (valgus/varus)

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
</tr>
</thead>
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<tr>
<td>Not Present</td>
<td>6</td>
</tr>
<tr>
<td>&lt; 10 degrees</td>
<td>6</td>
</tr>
<tr>
<td>10 to 20 degrees</td>
<td>4</td>
</tr>
<tr>
<td>&gt; 20 degrees</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sum (minimum)</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>12</td>
</tr>
<tr>
<td>Good</td>
<td>6</td>
</tr>
<tr>
<td>Fair</td>
<td>0</td>
</tr>
<tr>
<td>poor</td>
<td>0</td>
</tr>
</tbody>
</table>
The angulation was 5.8 which was good to excellent. Patients had good fracture reduction at the end of three months (Tables 6, 7).

The mean pain score was 3.8 in the hybrid fixator group at the end of three months. The mean extension was 3.8 in the fixator group. The mean range of movement was 3.8. The mean stability was 5.8. The mean walking capacity was 1.85. The Rasmussen functional grading was 19 which was graded as good and acceptable. So, at three months, the quality of fracture reduction was good (Fig 13).

At six months, the mean WOMAC score was 44.05 in the hybrid fixator group. The mean Rasmussen’s anatomical score was 16.25. The mean Rasmussen’s functional score was 22.15. The various parameters showed a good anatomical reduction and functional improvement (Fig 14) (Table 6, 7).

At one year postoperative period also, the WOMAC score and Rasmussen’s scores were similar (Fig 15). There was no radiological evidence of osteoarthritis during the study period.

### DISCUSSION

High energy trauma is considered as a major cause of poor results in the treatment of tibial plateau fractures. Mahadeva et al, comparing external to internal fixation, concluded that hybrid external fixation possesses theoretical advantages in terms of the soft tissues protection; however the benefit over internal fixation is modest as far as accuracy of reduction is concerned[22]. The evidence of osteoarthritis in the form of progressive obliteration of joint space, osteophyte formation and subchondral sclerosis has been recorded in studies of longer duration [2, 5]. In a study by Chan et al., 26% from the hybrid group and 29% from the ORIF group developed radiological evidence of osteoarthritis[6]. Our study did not show any radiological evidence after twelve months and the patients need further follow up for this.

Postoperative infection was seen in 10% of both groups in our study. Pin

### Table 4: Comparison between the groups in terms of fracture, soft tissue injury, concomitant fracture etc.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group</th>
<th>Mean</th>
<th>+ SD</th>
<th>t test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of Hospital Stay (Days)</td>
<td>ORIF</td>
<td>13.50</td>
<td>4.15</td>
<td>6.541</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Hybrid Fixator</td>
<td>6.75</td>
<td>2.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Blood Loss (ml)</td>
<td>ORIF</td>
<td>498.50</td>
<td>80.61</td>
<td>14.633</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>Hybrid Fixator</td>
<td>222.00</td>
<td>25.36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Note the lesser blood loss and decreased hospitalisation for the hybrid fixator group

### Table 6: Functional and anatomical scores of ORIF during post op

<table>
<thead>
<tr>
<th>Score</th>
<th>3 months</th>
<th>6 months</th>
<th>One year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rasmussen’s functional score</td>
<td>19.75</td>
<td>22.4</td>
<td>22.55</td>
</tr>
<tr>
<td>Rasmussen’s anatomical score</td>
<td>17.3</td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td>WOMAC score</td>
<td>44.55</td>
<td>44.3</td>
<td>43.8</td>
</tr>
</tbody>
</table>

### Table 7: Showing the various scores of hybrid fixator at 3, 6 and 12 months post op

<table>
<thead>
<tr>
<th>Score</th>
<th>3 months</th>
<th>6 months</th>
<th>One year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rasmussen’s functional score</td>
<td>19</td>
<td>22.15</td>
<td>22.25</td>
</tr>
<tr>
<td>Rasmussen’s anatomical score</td>
<td>17.1</td>
<td>16.25</td>
<td>16.25</td>
</tr>
<tr>
<td>WOMAC score</td>
<td>44.05</td>
<td>44.05</td>
<td>43.6</td>
</tr>
</tbody>
</table>
tract infection was the most common complication. In Chan’s study, infection was more common in the hybrid group (26%) than in the ORIF group (19%). Our infection rate is comparable to the study by Babis et al\textsuperscript{23}.

Duration of hospital stay in days was found to be significantly prolonged for ORIF group and so was the average blood loss. Our observations were similar to other studies conducted by Chan, Hisham etc.\textsuperscript{2, 3, 6} In the postoperative period, there was no statistically significant difference between WOMAC score and Rasmussen’s scores\textsuperscript{24} (Tables- 6, 7). There was no radiological evidence of osteoarthritis during the study period. In Rasmussen’s anatomical score though, there were significant changes in terms of depression, angulation and condylar widening at six months (Fig- 13, 14, 15). In the first year significant changes continued to be seen in terms of depression and angular variation but there was no condylar widening. Overall, there was good anatomical reduction and functional improvement in both groups (Fig- 16, 17, 18). One point to be noticed here was the comparable results despite the hybrid fixator having a worse clinical scenario with more number of open injuries, soft tissue injury and complicated fractures.
LIMITATIONS
The study period was not sufficient to know the long term results. The main drawback of the present study was the non-randomised design, and the relatively small number of cases. The author acknowledges that a longer follow-up period would be preferred to further detect the development of osteoarthritis. A prospective study of a modern fine-wire external fixator and a minimally invasive plating system would also be a useful addition to the literature.

CONCLUSIONS
Minimally invasive reduction of fracture followed by hybrid fixator has been suggested as an alternative to open reduction and internal fixation in Schatzker type V and VI proximal tibial fractures with the aim to reduce surgical morbidity. In our study, both techniques—ORIF and hybrid fixator provided a reasonable quality of fracture reduction. Closed reduction and application of a hybrid fixator resulted in shorter hospital stay and lesser blood loss than ORIF. Hybrid fixator resulted in fewer and less severe complications, faster return of function, and similar or superior clinical outcomes when compared with ORIF. These benefits were obtained without compromising on the quality of fracture reduction.

We feel closed reduction with hybrid fixator is marginally superior to ORIF and should be considered in the treatment of difficult to treat proximal tibial fractures. A long term study is required to know the effects of both techniques on the development of osteoarthritis.

REFERENCES
Myxoedema Madness

Salini Nair, P C Kesavankutty Nayar, Chithra Venkateswaran

ABSTRACT
Myxoedema madness is a very rare but established entity. A psychotic patient having hypothyroid features should always be evaluated regarding the same.

INTRODUCTION
The prevalence of overt, or clinical, hypothyroidism is approximately 2 percent in women and less than 0.1 percent in men. Subclinical hypothyroidism also predominates in women, occurring in approximately 7.5 percent of women and 3 percent in men. Hypothyroidism is traditionally defined as deficient thyroidal production of thyroid hormone.

Hypothyroidism ranges from very mild cases to very severe cases in which the danger exists to slide down into a life-threatening myxoedema coma.

Hypothyroidism is thus a graded phenomenon, in which the first stage of subclinical hypothyroidism may progress via mild hypothyroidism towards overt hypothyroidism.

The most common cause of hypothyroidism is destruction of the thyroid gland by disease or as a consequence of vigorous ablative therapies to control thyrotoxicosis. Primary hypothyroidism may also result from inefficient hormone synthesis caused by inherited biosynthetic defects, a deficient supply of iodine, or inhibition of hormonogenesis by various drugs and chemicals. In such instances, hypothyroidism is typically associated with thyroid gland enlargement (goitrous hypothyroidism).

Psychiatric symptoms include depressed mood, apathy, impaired memory and concentration. Psychotic symptoms, including paranoid ideas, misidentification, visual and auditory hallucinations, and thought disorder, were originally thought to be common and described as myxedema madness, but likely occur in less than 5 percent of all patients with hypothyroidism and tend to emerge after the onset of physical symptoms. Myxoedema madness is an acute or chronic organic brain syndrome occurring in cases of severe hypothyroidism. An array of psychotic symptoms, including delusions, visual and auditory hallucinations, paranoia, and thought disorders, have been reported secondary to hypothyroidism. Severe hypothyroidism, especially in the elderly, may present with confusion or even coma.

Myxoedema coma is very rare: hypothermia is often present and the patient may have severe cardiac failure, pericardial effusions, hypoventilation, hypoglycaemia and hyponatraemia.

Severe hypothyroidism also leads to several cardiovascular effects including bradycardia, decreased myocardial contractility, a low cardiac output and hypotension. All of these cardiac changes are reversible with thyroid hormone replacement.

Respiratory depression can lead to hypoventilation and respiratory acidosis. Ventilatory support is needed in some patients, and full recovery from respiratory depression can take up to three to six months following treatment. The involvement of many organ systems necessitates managing myxoedema coma patients in an intensive care setting.

The mortality rates may be as high as 25–60% even with best possible treatment. Recent developments in brain imaging techniques provide novel insights in the relationship between hypothyroidism and mood disorders.

CASE REPORT
A 46 year old lady presented with symptoms of low mood, suspicious behaviour, reduced sleep and reduced intake of food of 6 months duration. Patient also had gradual onset of difficulty in walking over the past 3 years, and as a result was unable to go for work, which then progressively increased over the past 6 months. Patient was brought to outpatient department of psychiatry and was admitted for further evaluation. Physical examination revealed non-pitting oedema, hoarseness of voice, puffiness of face, paucity of speech and psychomotor activity was decreased. Neurological examination revealed delayed deep tendon reflexes, power was reduced on b/l upper and lower limb. On mental status examination, patient had poor eye contact, low tone rough voice with a paucity of...
speech. She was oriented to time, place and person. Patient was guarded and depressive features and paranoid delusions were reported. Suicidal wishes were not reported and her affect was apathetic. Patient was started on low dose mirtazapine, olanzapine. Clonazepam was added for her complaints of insomnia.

Detailed evaluation revealed laboratory values of a TSH level of more than 100 µU/ml (reference range: 0.50–5.00 µU/mL), thyroxine (T4) level of less than 0.4 (reference range: 4.5–10.9 µg/dL) and total triiodothyronine (T3) level of 1.98 (reference range: 60–181 ng/dL). Her parathyroid hormone level was 302.2 pg/mL (reference range -15.0–68.0pg/mL). As the initial calcium level of the patient was borderline high, work-up of vitamin D and parathyroid hormone was done, in view of hypercalcemia. Initial calcium level was 13mg/dL and repeat value was found to be 8.3mg/dL, initial vitamin D level was 2ng/ml when repeated later on, was found to be 64.95ng/ml, phosphorous level was found to be 5mg/dL and repeat value was later found to be 3.34mg/dL. Neurology department evaluated her and advised further investigations, of which nerve conduction study (NCV) revealed evidence of carpal tunnel syndrome. They advised to continue thyroxine supplementation and supportive therapy.

General blood profile revealed that patient was anaemic with a haemoglobin value of 7.4 g/dL. Patient’s family members report that patient was found to be anaemic 3 years back but had refused treatment. Peripheral smear showed microcytic hypochromic anaemia. General medicine department evaluated the patient and oral iron supplementation was given. One pint packed cell blood transfusion was given as the haemoglobin value decreased again. Her vitamin D3 level was found to be 3.12 on evaluation. Patient was started on thyroxine 50 µg after consultation from the endocrine department of our hospital, which was later increased to 75µg, after electrocardiogram and chest x-ray were found to be normal.

Further on the 14th day her saturation dropped to 83 in room air, maintaining at 90 with 5 litres of O2. Her pulse rate was around 96 beats per minute. Her blood pressure recording was 180/110mmHg, which then dropped to 140/90mmHg. Periorbital oedema was present. Hyperthermia+ and peripheries were cold. Patient was diagnosed with myxodema coma. Patient was shifted to ICU and then put on ventilator support, with consent from family members. Electroencephalogram showed evidence of epileptiform seizures. Tra- cheostomy was done at a later stage. TSH values then dropped to 1.5 µU/ml and T4 of 1.61 µg/dL. Thyroxine supplementation was given orally in view of high TSH value with a maximum dose of 150 µg/day and minimum dose of 50 µg/day, dosage was modified according to response. Patient was then slowly tapered off parenteral medications and oral antiepileptics were gradually introduced. Patient spent a total of 47 days in ICU, under Neurology department and was then later shifted out to Physical Medicine department for rehabilitation. Thus in our case patient had initially presented with psychiatric manifestations and was found to have an organic background suggestive of organic psychosis which improved with symptomatic treatment. Initially hyponatraemia and hypercalcemia was diagnosed, possibly dehydration-induced hyponatraemia, which later came down to normal levels. Repeat sodium level was 137mEq/l and repeat calcium level was 8.3mg/dL.

DISCUSSION

In our study, it was observed that the patient had initially presented with depressive symptomatology and paranoid delusions.

In a study conducted by the Committee of the Clinical society of London, the study noted 109 patients of myxoedema and reported that “delusions and hallucinations occur in nearly half of the cases mainly with advanced disease”.

In another study by Westphal et al, it was observed that patients with hypothyroidism presented with rare manifestations, and the initiation of thyroid hormone therapy resulted in significant improvement of the presenting symptoms.

Asher reiterated the relationship between psychosis and hypothyroidism in 1949 and added the terminology “myxoedema madness” to the literature. Since that time, numerous case reports have continued to explore and report on the diverse physical and psychiatric consequences of hypothyroidism. Although Asher’s study of 14 patients and resulting description of myxoedema madness has been often cited as a typical example of psychosis secondary to hypothyroidism, subsequent case reports have revealed considerable variation in clinical psychotic presentations.

In a study by Ghasem et al, a patient presenting with behavioural changes and hypothyroidism was treated with a combination of antipsychotics and levothyroxine. They illustrated the importance of ascertaining the thyroid status in patients presenting with psychosis and behavioural changes and the need to consider hypothyroidism in the differential diagnosis of new onset psychosis.

The range of physical and psychiatric presentations...
and their potential subtle manifestations make hypothyroidism a diagnosis that is easy to miss. Behavioural changes may occur in the absence of the classical physical signs and symptoms of the disorder.

Since psychiatric complaints may be one of the earliest manifestations of hypothyroidism, they are often misdiagnosed as functional psychiatric disorders, rather than a psychiatric disorder due to a general medical condition. This confusion leads to delayed treatment and a high likelihood of increased morbidity.

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Primary Urachal Mucinous Adenocarcinoma of the Urinary Bladder

Jeena V Chimmen*, C S Sakunthala Bhai*, S Shenoy MS**, Tanya S Ponnatt*

ABSTRACT
Primary urachal mucinous adenocarcinomas are rare and aggressive neoplasms that arises from the urachus, a vestigial musculofibrous band that extends from the dome of the bladder to the umbilicus. They account for only 0.5 – 2% of all the bladder tumours. The advanced stage at presentation due to the delayed onset of symptoms results in poor prognosis. We report a case of a 57 year old gentleman with primary urachal mucinous adenocarcinoma; to increase the awareness of this aggressive but clinically silent neoplasm with dismal prognosis.

Key words: Urachus, adenocarcinoma, bladder.

CASE REPORT
A 57yr old man presented with haematuria of one month duration. Physical, urological and rectal examination was unremarkable.

Blood routine and Renal function tests were normal. Computed tomography of abdomen showed solid extravesical mass extending into the dome and anterior wall of the urinary bladder suggestive of urachal carcinoma. Cystoscopic biopsy from the mass confirmed urachal adenocarcinoma. Colonoscopy was done to exclude primary colonic malignancy.

Patient underwent partial cystectomy with en-bloc excision of the urachal growth. Gross specimen revealed bladder mucosa with an ulcerated polypoidal grey white growth with mucinous areas (m) 4.2x3.8x3.4cm extending into the urachus. Histopathology showed a malignant tumor with neoplastic cells arranged in glandular pattern and in groups separated by pools of extracellular mucin. Moderate nuclear atypia and mitotic figures were seen. Final diagnosis was urachal mucinous adenocarcinoma invading the muscle layer and the mucosa of the bladder.

Patient was referred to medical oncology for further treatment.

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DISCUSSION

The urachus is a thick tube like structure, that is formed in the embryo as the allantois involutes. It extends from the bladder dome to the umbilicus. Remnants of allantois are usually seen in the dome of bladder and rarely in the anterior and posterior bladder wall. Neoplasm arising from such remnants are usually adenocarcinoma. Urachal tumors are rare and aggressive cancers of bladder which were originally described by Hue and Jacquin in 1863. They account for only 0.5% of all bladder malignancies and 20-40% of primary bladder adenocarcinomas. Hematuria is the most common presenting symptom in about 90% of patients.

Most urachal adenocarcinomas have enteric features and are mucinous. Some may have signet ring cell component.

MD Anderson Cancer Centre MDACC suggested 5 criteria for the diagnosis of urachal cancers (Table-1)

![Fig 5. Urachal Adenocarcinoma. H&E 40x](Image)

![Fig 6. Urachal adenocarcinoma with overlying normal urothelium](Image)

The MD Anderson Cancer center criteria for the Diagnosis of urachal cancer

<table>
<thead>
<tr>
<th>Main Criteria</th>
<th>Supportive criteria</th>
</tr>
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<tbody>
<tr>
<td>• Location in the bladder dome or elsewhere in the midline of the bladder</td>
<td>• Enteric type histology</td>
</tr>
<tr>
<td>• sharp demarcation between tumour and normal surface epithelium</td>
<td>• Absence of urothelial dysplasia</td>
</tr>
<tr>
<td></td>
<td>• Absence of cystitis cystica or cystitis glandularis transitioning to tumour</td>
</tr>
<tr>
<td></td>
<td>• Absence of primary adenocarcinoma of another origin</td>
</tr>
</tbody>
</table>

Table 1

Staging systems for urachal cancers

<table>
<thead>
<tr>
<th>Stage</th>
<th>1984: Sheldon et al</th>
<th>2006: Ashley et al</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Confined to urachal mucosa</td>
<td>Confined to urachas and bladder</td>
</tr>
<tr>
<td>II</td>
<td>Invasion Confined to urachus</td>
<td>Extension beyond muscularis of urachas and/or bladder</td>
</tr>
<tr>
<td>III</td>
<td>-</td>
<td>Metastatic to regional lymph nodes</td>
</tr>
<tr>
<td>IIIA</td>
<td>Extension to bladder</td>
<td></td>
</tr>
<tr>
<td>IIIB</td>
<td>Extension to Abdominal wall</td>
<td></td>
</tr>
<tr>
<td>IIIC</td>
<td>Extension to Peritoneum</td>
<td></td>
</tr>
<tr>
<td>IIID</td>
<td>Extension to other Viscera</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>-</td>
<td>Metastatic to nonregional lymph nodes/distant sites</td>
</tr>
<tr>
<td>IVA</td>
<td>Metastatic to lymph nodes</td>
<td></td>
</tr>
<tr>
<td>IVB</td>
<td>Metastatic to Distant sites</td>
<td></td>
</tr>
</tbody>
</table>

Table 2
The criteria include midline location of the tumor, a sharp demarcation between the tumor and normal surface epithelium, an enteric histology, the absence of urothelial dysplasia, cystitis cystica or cystitis glandularis transitioning to the tumor and the absence of a primary adenocarcinoma of another origin\(^9\). All of the criteria were satisfied in our reported case. Immunohistochemistry may help the distinction between the primary and secondary carcinoma. In primary adenocarcinoma of the bladder CK 7 and CK 20 are positive in contrast with colonic adenocarcinoma that express only CK 20\(^9\).

Two systems have been proposed for staging urachal cancer. In the first system by Sheldon and colleagues in 1984\(^10\), early stage urachal cancers are localised to the urachal mucosa while late stage disease involves the local structures such as bladder, abdominal wall or peritoneum and metastasis to regional lymphnodes or distant sites.

The mayo clinic recently proposed a more simplified system\(^11\) Table 2. But none of them are validated.

Partial cystectomy with en-bloc urachectomy upto the umbilicus is the treatment of choice as, urachal tumors can occur anywhere along the urachus including the umbilicus. Unlike other cancers there is currently no adjuvant chemotherapy regime for treatment of Urachal cancers, but it has been used in some studies\(^12,13,14\) with variable efficacy.

CONCLUSION

Primary urachal adenocarcinoma in addition to being a rare and aggressive tumor is also known to pose significant diagnostic challenges.

Further studies are warranted for better treatment strategies and better outcome.

Competing interests : None declared

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