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Maxillofacial Injuries and Its Implications on Economic Burden in Trauma Victims.

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ABSTRACT

Aim: The objective of this study was to assess the Economic burden on the patients with maxillofacial injuries.

Materials and Method: After obtaining institutional ethical clearance, a prospective approach was taken to identify patients admitted with maxillofacial injuries from June 2017 to February 2018. Information related to the nature and severity of injury and treatment were recorded along with the total treatment cost and duration of hospitalization. Maxillofacial injury severity score (MFISS) and facial injury severity scale (FISS) were used to score the maxillofacial injury. To assess the economic burden, the MFISS and FISS scores were correlated with economic burden markers namely cost and duration of hospitalization.

Results: A total of 129 patients with maxillofacial injuries were identified (115 males, 14 females; mean age = 35.14 years). 104 patients (80.62%) were involved in Road Traffic Accidents and only 58 patients (44.96%) were covered under medical insurance. The mean MFISS and FISS scores were 13.62 (standard deviation [SD] = 9.53; range = 3-48) and 2.70 (SD = 1.935; range = 1-10), respectively. The mean expenditure and length of stay in the hospital of the patients were INR 36643.42 (SD = 46165.817; range INR 1657-253948) and 5.5 days (SD = 6.741; range 0-34 days) respectively. Spearman's correlation between the MFISS and FISS scores and the cost and duration of hospitalization, revealed statistically significant correlations (MFISS vs. cost - $R = 0.398$, $P < 0.01$; MFISS vs. duration - $R = 0.477$, $P < 0.01$; FISS vs. cost - $R = 0.429$, $P < 0.01$; FISS vs. duration - $R = 0.433$, $P < 0.01$).

Keywords: *Maxillofacial injury, trauma, economic burden, MFISS, FISS*

INTRODUCTION

The facial skeleton protects the brain; houses and protects the sense organs of sight, smell, and taste. It provides a framework for the facial muscles to attach onto and help in eating, breathing, facial expressions and speech.[1] The Frontal bone, Maxilla, Zygoma, Nasal bones and Mandible are the important bones forming the basic structure of the face.[2]Maxillofacial trauma is any physical injury to the face, which may involve the soft tissue injuries such as cuts, burns and bruises, or fractures of the facial bones such as the fractures of the jaw and nasal bone, as well as eye injuries.The effect of maxillofacial injuries result in interruption of various critical functions of the head and neck region, such as, visual acuity, olfaction, auditory perception, speech, breathing, and eating, which are exceptionally vital for an ordinary day to day living of a person.[3]This can lead to mental agony in the patients after injury. Mental morbidities are one of the complexities following road traffic accidents and maxillofacial injury.[4]

Emergency physicians and surgical specialists in various specialties like Oral and maxillofacial surgery,

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ENT, Neuro surgery, Ophthalmology and Plastic surgery are required to work harmoniously in order to manage multiple trauma victims which accounts for more than 50% .[5]Because of the lack of awareness regarding medical insurance and poor social medical coverage, a major portion of the expenses of the medical services used is borne by the patients' themselves.[6] Studies have demonstrated that patients with maxillofacial injuries experience the ill effects of severe anxiety issues. In spite of well-known worldwide familiarity with these issues, there is as yet lacking information on mental anxiety in cases of maxillofacial injury.[7]It is vital to consider that for each death there are numerous survivors who are left with permanent impairing injuries. And the extent of trauma care for these injuries influences the working populace, such that, death or disability diminishes work and their spending capacity.[8]

The World Health Organization (WHO) reports that about 1.25 million people die annually on the world's roads, with 20–50 million sustaining non-fatal injuries.[9] According to Indian Society for Trauma and Acute Care, India Loses approximately 2-2.5% of its GDP to only Road Traffic Injuries. Transport related Injuries constitutes 22.8% of all trauma cases. Majority of 77.2% accounts for other forms of trauma such as, falls, occupational trauma, intentional self-harm, assault, burns and drowning, natural disaster, terrorist attacks. Every 2 minutes, a trauma-related death occurs in India.[10]Many researchers have published the rate and treatment of facial trauma, all the same, the real cost of dealing with these injuries are not as often as possible revealed.[11] In light of the fact, the doctor's choice on the method of treating a patient impact up to 35% of aggregate treatment cost.[12]

The dominant part of treatment costs comprises of the supposed hospitalization costs which include expenses of accommodation, surgery, and drugs which in turn surges with the duration of treatment. When we consider advantages of open treatment procedures, speedy recuperation and higher personal satisfaction weigh down the high expenses incurred in treatment. The study endeavours to evaluate the financial burden incurred post injury. It also explores other options to overcome difficulties so as to make affordable care accessible to the underprivileged.

METHODOLOGY

A cross-sectional study with all cases of maxillofacial injury visiting the trauma center from June 2017 to February 2018 were included. Patients below the age of 18 years, brought in dead patients and patients not willing to participate were excluded from the study. The study included 129 participants treated for maxillofacial injuries by Department of Oral and Maxillofacial Surgery. Data collection was done in relation to social demographics, etiology of injury and the fracture area of maxillofacial region. Clinical information pertaining to the maxillofacial injury and treatment modality of the patient was obtained from the medical records department of the hospital. The pattern of facial injury was determined according to the fractures of frontal bone, mandible, and mid face in relation to the different etiological factors. Patients were scored depending on the nature of their maxillofacial injuries using Maxillofacial Injury Severity Score (MFISS) [13] and Facial Injury Severity Score (FISS) [14].

For the study, the mandible was divided into condylar, coronoid, ramus, body, symphysis, and dento-alveolar regions. In the middle-third of the face, injuries were recorded as Le Fort, I, II, and III types, zygomatic complex, nasal bones, naso-orbito-ethmoidal complex and dento-alveolar fractures. The frontal sinus and orbital rim were recorded for injuries of the upper face. Etiological factors were classified as road traffic accidents, slip and fall, assault, occupational hazards and sports injuries. For breaking down the financial burden, information on cost and duration of hospitalization was obtained. Cost of hospitalization- The total financial expense incurred by the patient for treatment of the maxillofacial injury which includes pre-treatment investigations, surgical procedures, and post treatment medication, consumables and therapy.

Duration of hospitalization: The number of days from admission until discharge of the patient was taken into account.

Details of hospitalization and treatment procedures, including the nature of treatment, treatment cost (in Indian Rupees [INR]), duration of hospitalization (in days), payment method and medical insurance coverage was obtained from the finance department of the hospital. These variables will be analysed to determine most common gender, age, etiology, fracture site and payment type. The data obtained was then analysed using SPSS on various scales and measures.

RESULTS

A total of 129 patients fulfilling the inclusion criteria were identified. There were 115 male patients and 14 female patients with a mean age of 35.14 years (range = 18-86 years). Road traffic accidents (RTA) were the largest cause of maxillofacial injuries (104 cases, 80.62%), followed by falls (15 cases, 11.63%), interpersonal assaults and sports injuries (16 cases, 12.4%) and industrial accidents (4 cases, 3.1%). (Table 1) The mean MFISS and FISS scores were 13.62 (standard deviation [SD] = 9.53; range = 3-48) and 2.70 (SD = 1.935; range 1-10) respectively. While the mean cost of hospitalization of the patients was INR 36643.42 (SD = 46165.817; range INR 1657-253948), the mean duration of hospitalization was 5.5 days (SD = 6.741; range 0-34 days). (Table 3)

Agreement between the scores and the markers of economic burden were evaluated using Bland-Altman plots (Graphs 1-4). With 58 patients (44.96%) under medical insurance coverage, of the remaining patients, 59 (45.74%) paid for their own medical expense, patient's family paid for 8 (6.2%) of them, while 4 patients (3.1%) were sponsored by their employers.(Table 1)Statistical analysis using Spearman's correlation between the FISS and MFISS scores and the independent variables of cost and duration of hospitalization revealed statistically significant correlations. The FISS scores of the patients showed a positive correlation with the cost ($R = 0.429$, $P < 0.01$) and duration ($R = 0.433$, $P < 0.01$) of hospitalization. Similarly, the MFISS scores of the patients showed a positive correlation with the cost of hospitalization ($R = 0.398$, $P < 0.01$) and duration of hospitalization ($R = 0.477$, $P < 0.01$) (Figs 1-4).

Table 1: Socio-demographic characteristics of respondents

Characteristics	Frequency (%)
Age (years):	
18-30	60 (46.52%)
31-45	42 (32.55%)
46-60	21 (16.28%)
Above 60	6 (4.65%)
Gender:	
Male	115 (89.15%)
Female	14 (10.85%)

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Medical expenses:	
Self	59 (45.74%)
Family	8 (6.2%)
Employer	4 (3.1%)
Insurance	58 (44.96%)
-Medicare	9 (6.98%)
-Manipal Arogya Suraksha	28 (21.7%)
-Manipal Sampoorna Suraksha	4 (3.1%)
-Mukhyamantri Santwana Harish Scheme	12 (9.3%)
-ESI; Corporate TPA	7 (5.4%)
-Charitable trust (Shankar fund; Dr. Hegde fund) (*In addition to other payment methods)	5* (3.88%)

Table 1: The above table shows 60 respondents fall in the age group of 18 to 30 years and only 6 respondents in elderly category, with M: F ratio of 8.9: 1. 44.96% had access to medical insurance whereas 45.74% paid out of pocket.

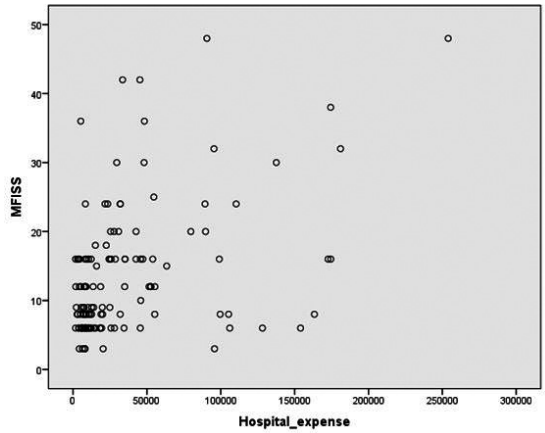
Table 2: Injury and treatment characteristics of respondents

Characteristics	Frequency (%)
Etiology:	
RTA	104 (80.62%)
Slip and Fall	15 (11.63%)
Assault	5 (3.88%)
Occupational injuries	4 (3.1%)
Sports injuries	1 (0.77%)
Fracture site	
Frontal	6 (4.66%)
Mid-face	68 (52.71%)
Mandible	20 (15.5%)
Frontal + Mid-face	5 (3.88%)
Frontal + Mandible	1 (0.77%)
Mid-face + Mandible	27 (20.93%)
Frontal + Mid-face + Mandible	2 (1.55%)
Treatment Procedure	
Open reduction/Surgical	47 (36.4%)
Closed reduction/Non-surgical	82 (63.6%)

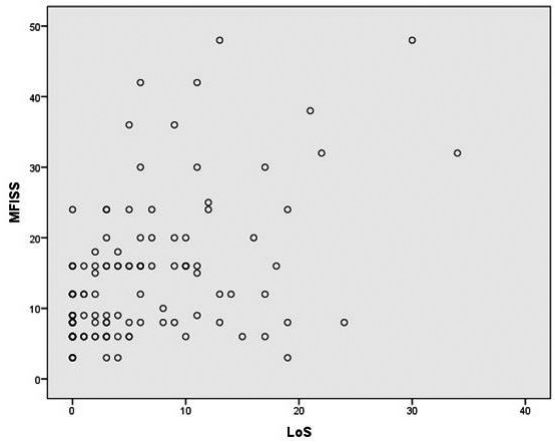
Table 2: RTAs accounted for 80.62% of cause of trauma and Mid-face was the most affected constituting 52.71% of respondents followed by mid-face and mandible at 20.93%.

Table 3: Range scores for Hospital expense, Length of stay, FISS, MFISS among the participants

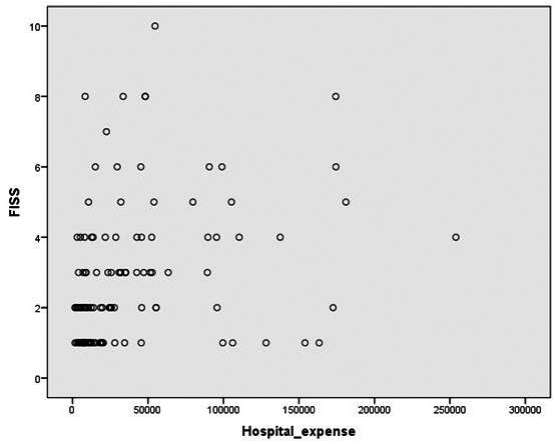
	Minimum	Maximum	Mean	Std. Deviation
Hospital Expense	1657	253948	36643.42	46165.817
Length of Stay	0	34	5.50	6.741
FISS	1	10	2.70	1.935
MFISS	3	48	13.62	9.530



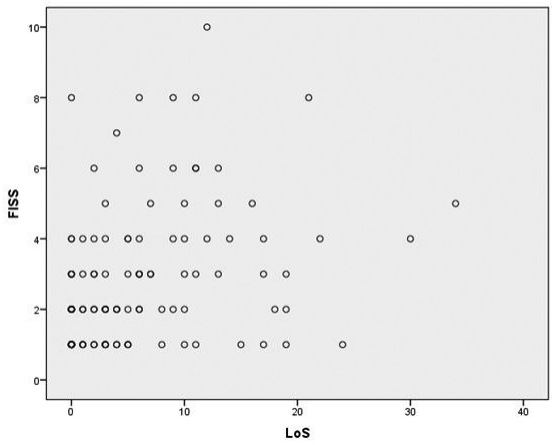
Graph 1: Bland-Altman plot showing the correlation between Maxillofacial Injury Severity Score (MFISS) and the Hospital expense. Rho value – 0.398 (weak positive correlation)



Graph 2: Bland-Altman plot showing the correlation between Maxillofacial Injury Severity Score (MFISS) and the hospital length of stay. Rho value – 0.477 (weak positive correlation)



Graph 3: Bland-Altman plot showing the correlation between Facial Injury Severity Scale (FISS) and the Hospital expense. Rho value – 0.429 (weak positive correlation)



Graph 4: Bland-Altman plot showing the correlation between Facial Injury Severity Scale (FISS) and the hospital length of stay. Rho value – 0.433 (weak positive correlation)

DISCUSSION

The injury severity measurement is a widely discussed topic and commonly executed approach. It is a very useful in determining the possible prognosis, treatment outcomes in trauma patients, and also to assess the cost of injuries post trauma.[13]The available scoring systems does not focus solely on the maxillofacial region and in few circumstances the importance of such injuries have been undermined. The development of trauma specific scoring system can aid the clinician in classifying and prompt assessment of such injuries.

The Maxillofacial Injury Severity Score (MFISS) proposed by Zhang et al. limits the evaluation of injuries to the maxillofacial region setting aside of other bodily

injuries that may be present in the patient. It made use of the Abbreviated Injury Scale (AIS). MFISS is designed for selecting the three highest maxillofacial injury severity scores according to the AIS-90 standard and then combine them with the ISSs for three maxillofacial functional parameters: malocclusion (MO), limited mouth opening (LMO) and facial deformity (FD). MFISS being a derivative of AIS, inherits the problems in evaluation of comminution. Another drawback being the functional parameters cannot be recorded in retrospect.[14]

Facial Injury Severity Score (FISS) on the other hand, includes the classification of laceration of the facial soft tissue and that of bone. Here, the facial bones are divided into the upper, middle, and lower thirds, with an addition of 1 item for facial laceration. However, because of insufficient description of the classification of bones, it cannot be used to distinguish displaced and comminuted fractures.[15]In a study reported by Ramalingam S, the treatment expenses borne by the patients as a result of traumatic injuries was analysed retrospectively in a small subset of the South Indian population. It was interesting to note, only 17.9% of the studied patients had access to medical insurance, and the remaining patients managed their medical expenses out of pocket. The author found a direct relationship between the length of hospitalization and the burden of expenditure.Furthermore, a positive correlation was found between the MFISS score and the duration of hospitalization ($R = 0.828$, $P < 0.01$), and that with the cost of treatment ($R = 0.862$, $P < 0.01$).[6]

In another study by Chen et al. to select a scoring system which will be suitable for the scoring of maxillofacial trauma by comparing four commonly used scoring systems. For this study, twenty-eight subjects who had experienced maxillofacial trauma were recruited as the cohort. Four commonly used systems were selected: New Injury Severity Score (NISS), Facial Injury Severity Scale (FISS), Maxillofacial Injury Severity Score (MFISS), and Maxillofacial Injury Severity Score (MISS). Each patient was graded using these 4 systems. An expert scoring table was created, using their experience at the trauma centre. The injuries of these 28 patients was graded by 35 experts in maxillofacial surgery, using the expert scoring table according to their clinical experience. A normal distribution was demonstrated by the results of the 4 scoring systems and expert score. A significant difference ($P < .01$) was also noted. Pearson correlation coefficient between the MFISS and expert score was the greatest (0.801). They also found the correlation coefficient between the NISS, FISS, and MISS and the expert score to be 0.714, 0.699, and 0.729, respectively. In comparison with the other 3 scoring systems, the correlation and agreement between the MFISS and expert score was greater. Their finding suggested that the MFISS is more suitable for scoring maxillofacial injuries.[16]

CONCLUSION

The practice of assessment of maxillofacial trauma has come a long way. Availability of trauma specific scoring systems can aid clinicians in evaluating and assessing cases of high severity with gross comminution.[13] From the present study, using MFISS and FISS we can not only predict indicators of maxillofacial injury severity, but also use the scores as indicators of the economic burden to the patient as a result of maxillofacial injury. The study involved only a small subset of the population. A multi-centre study would be helpful to obtain a bigger picture of the injured population.

Ethical Clearance: Taken from the Institutional ethics committee

Source of Funding: Self funded.

Conflict of Interest: Nil.

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