



ETIOLOGY AND PATTERNS OF FRACTURE IN MAXILLOFACIAL TRAUMA -A PROSPECTIVE STUDY.

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ABSTRACT

Introduction: Trauma to the facial region range from soft tissue injuries to complex fractures of the underlying structures¹. Pattern and severity of the maxillofacial injuries depend on the site, direction and magnitude of the force over the anatomical sites^{2,3,4}. Maxillofacial trauma varies worldwide due to social, cultural, economic diversities, awareness of traffic rules and alcoholic consumption⁵. Over the past decades the incidence of maxillofacial trauma has increased considerably due to increasing urbanization and industrialisation⁶. **Materials and Methods:** We conducted a prospective study of 150 patients with maxillofacial injuries attempted to know the incidence, aetiology and fracture pattern of the maxillofacial trauma with its management at our teaching institute. **Results:** Road traffic accident was the most common cause for maxillofacial injuries. Nasal bone fracture was the most common fracture among all facial fractures. Injury to the mandibular condyle was the commonest among all mandible fractures. The maxillary fractures were primarily Le Fort II. **Conclusion:** Road traffic accident was the major cause of maxillofacial trauma. The younger age group was affected. Nasal bone fractures were commonly noted. Careful consideration should be given to the nature of trauma and anatomical site affected. As wisely said prevention is better than cure, Educating the public regarding the preventive measures needs to be implemented.

KEYWORDS

maxillofacial fractures, traffic accidents, maxillary fractures, mandible

INTRODUCTION

The aetiology for maxillofacial trauma includes motor vehicle accidents, physical assault, self-fall, domestic violence, occupational hazards, sports, gunshot and warfare injuries⁷. In many developed countries physical assault accounts for the most of maxillofacial trauma while road traffic and motor vehicle accidents in developing countries^{8,9}. Of the published data maxillofacial trauma accounts for 7.4-8.7 % of hospital emergencies¹⁰.

Maxillofacial injuries are high and challenging because of their close proximity to the brain, neck and cervical region. This region serves several functions like vision, olfaction, mastication, respiration and phonation. Functions get impaired following injury leading poor quality of life. Facial scarification and deformities lead to aesthetic issues causing severe impact on psychological aspect of an individual leading to depression anxiety and post-traumatic stress disorders leading to delay in recovery and prolongs the duration of treatment¹⁰.

In our study we attempted to know the incidence, aetiology and fracture pattern of the maxillofacial trauma with management at our teaching institute.

MATERIALS AND METHODS

This study was conducted in patients who sustained maxillofacial trauma and were admitted in the department of Otorhinolaryngology in a tertiary care centre. A total of 150 patients were included in the study during the course between January 2021 and November 2022. This was a prospective study and approved by the institutional ethical committee. Initial evaluation was done upon the arrival of patients post-accident and presence of associated cranio-cervical injuries and polytrauma were noted. Proper evaluation of patients vitals, airway and excessive haemorrhage were considered as a primary goal. The diagnosis was made based on patient's history, clinical examination and radiological investigation. Radio diagnosis was based on Lateral view, PA skull and CT scans based on the indication. Collected parameters included patients age, gender, marital status, location of maxillofacial injuries, mechanism of injury, alcohol consumption, treatment modalities and period of treatment.

The patients were divided into 3 groups based on age. Group 1 - 3-20 years, Group 2 - 21-40 years, Group 3 - more than 40 yrs. The aetiology of injuries included road traffic accidents, physical assault, sports, self-fall and occupational hazard. The underlying fractures were classified into mandible fractures (ramus, body, condyle, coronoid symphysis and parasymphysis fracture), maxilla, nasal fractures, frontal and fractures of zygoma (arch and body). The modality of treatment included conservative management, closed reduction, open reduction and internal fixation.

The obtained data was statistically analysed.

RESULTS AND ANALYSIS

For the period of 23 months, a total of 150 patients were examined, treated for maxillofacial trauma. The age range was between 3 years to 65 years old. A total of 87 (58%) patients in the study group fell into the age group of 21-40 years. The least affected age group was above the age of 60 years.

Table 1: Distribution Of Patients Based On Age Group

AGE GROUP IN YEARS	NUMBER OF PATIENTS	PERCENTAGE
3-20	37	24.7
21-40	87	58
ABOVE 40	26	17.3

Gender Distribution

The study evaluated 126 males (84%) and 24 females (16%) giving a male to female ratio of 5.2:1. male gender constituted the highest number in all cases of maxillofacial trauma.

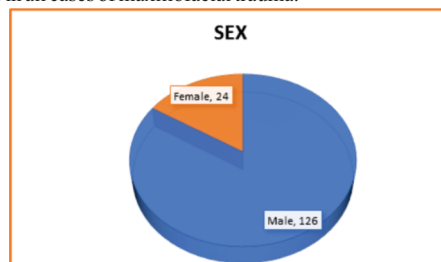


Fig1: Gender Distribution

Etiology Of Maxillofacial Trauma

RTA was the most common cause accounting for 101 (67.3%) cases of maxillofacial trauma. Other significant causes were physical assault with 20 (13.3%) cases followed by sports 18 (12%), self fall 5 (3.3%), occupational hazard 4 (2.7%) and domestic violence 2 (1.3%).

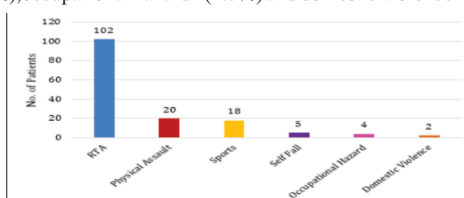


Fig 2: Distribution Of Patients Based On Etiology

Distribution Of Bone Fractures Caused By Maxillofacial Trauma

The table shows the distribution of fractures by their anatomical site among the patients treated for maxillofacial trauma at our institution. A total of 182 bone fractures were noted in 150 patients as few of the patients suffered multiple site fracture.

Of the maxillofacial skeletal fracture nasal bone fracture was the commonest with 78(42.8%) fractures due to its most protruding nature.

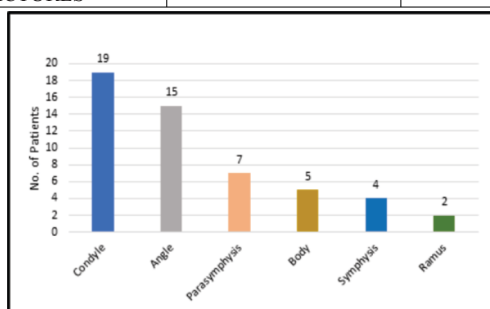
The number of patients with mandible fracture were 52(28.6%) . Out of all mandible fractures 19(36.5%) of them sustained injury to the mandibular condyle followed by 15(28.8%) at the angle ,7(13.5%) at the parasymphysis,5(9.6%) at the body,4(7.7%) at the symphysis followed by 2(3.8%) at the ramus .

The maxillary fractures were primarily Le Fort II 17(58.6%),Le Fort I 7(24.1%) followed by Le Fort III 5(17.2%).

There were 21(11.5%) of zygomatic fractures of which 14(66.6%) and 7(33.3%) were zygomatic body and arch fractures respectively. 2(1.1 %) patients sustained frontal bone fracture

Table 2: Distribution Of Fractures In Maxillofacial Trauma

BONE FRACTURE	NUMBER OF PATIENTS	PERCENTAGE
NASAL BONE	78	42.8
MANDIBLE	52	28.6
CONDYLE	19	36.5
ANGLE	15	28.8
PARASYMPHYSIS	7	13.5
BODY	5	9.6
SYMPHYSIS	4	7.7
RAMUS	2	3.8
MAXILLA	29	16
LE FORT I	17	58.6
LE FORT II	7	24.1
LE FORT III	5	17.2
ZYGOMA	21	11.5
BODY OF ZYGOMA	14	66.6
ARCH OF ZYGOMA	7	33.3
FRONTAL	2	1.1
TOTAL BONE FRACTURES	182	100

**Fig 3: Distribution Of Mandible Fractures****Treatment Modality**

In our study 42(53.8%) of nasal bone fracture underwent treatment by nasal splinting and the rest 36(46.1%) by conservative management.

Of the 52 patients with mandible fractures,31(59.6%) patients were treated by open reduction and internal fixation and 21(40.3%) with arch bar maxillomandible fixation.

29(16%) patients suffered fracture maxilla.25(86.2%) of Le forts were treated by intermaxillary fixation while the rest of 4 patients were just followed up.

Of the 21(11.5%) of zygoma fractures ,3(21.4%) of zygomatic body fracture and 2(28.5%) of zygomatic arch fractures needed no surgical

management .7(50%) of zygomatic body fracture were treated by open reduction and internal fixation and 4(28.5%) by bone elevation.similarly 5(71.4%) of zygomatic arch fractures also required bone elevation

All the 2(100%) patients with frontal sinus fracture required open reduction and internal fixation .

Table 3: Distribution Of Treatment Modalities Based On Site Of Fracture

Site Of Fracture	Closed Reduction/ Conservative	Open Reduction / Internal Fixation	Inter-maxillary Fixation/ mandible Fixation	Bone Elevation	Nasal Splint
Nasal Bone	36(46.1%)				42 (53.8%)
MANDIB LE		31 (59.6%)	21(40.3%)		
LE FORT	4(13.7%)		25(86.2%)		
BODY OF ZYGOMA	3(21.4%)	7(50%)		4(28.5%)	
ARCH OF ZYGOMA	2(28.57%)			5(71.4%)	
FRONTAL		2(100%)			

Table 4: Correlation Of Age And Etiology Of Fractures

Etiology	Age category (years)			Chi Square value	P value
	3 - 20	21 - 40	>40		
RTA				0.2337	0.2422
No	14 (37.84%)	29 (33.33%)	4 (17.39%)		
Yes	23 (62.16%)	58 (66.67%)	19 (82.61%)		
Physical Assault				0.0331	0.5713
No	34 (91.89%)	75 (86.21%)	19 (82.61%)		
Yes	3 (8.11%)	12 (13.79%)	4 (17.39%)		
Sports				0.0012	0.0150
No	28 (75.68%)	78 (89.66%)	23 (100.00%)		
Yes	9 (24.32%)	9 (10.34%)	0		
Self Fall				0.1322	0.6769
No	35 (94.59%)	84 (96.55%)	23 (100.00%)		
Yes	2 (5.41%)	3 (3.45%)	0		
Occupational Hazard				0.1192	0.3555
No	37(100.00%)	83 (95.40%)	23 (100.00%)		
Yes	0	4 (4.60%)	0		

Chi Square test was performed to see the association between RTA and Age category. It was found to be statistically not significant (P value is 0.2422).

Fisher's Exact test was performed to see the association between physical assault, sports, self fall, occupational Hazard and Age category. Only Sports was found to be statistically significant. (P value is 0.0150).

Table5: Correlation Of Etiology and Gender

Etiology	Sex		Chi Square value	P value
	Male	Female		
RTA			4.9928	0.0255
No	45 (35.71%)	3 (12.50%)		
Yes	81 (64.29%)	21 (87.50%)		
Physical Assault			0.0234	0.0445
No	106 (84.13%)	24 (100%)		
Yes	20 (15.87%)	0		
Sports			0.2469	0.7390
No	110 (87.30%)	22 (91.67%)		
Yes	16 (12.70%)	2 (8.33%)		
Self Fall			0.4128	1.0000
No	121 (96.03%)	24 (100%)		
Yes	5 (3.97%)	0		

Occupational Hazard			0.4940	1.0000
No	122 (96.83%)	24 (100%)		
Yes	4 (3.17%)	0		

Chi Square test was performed to see the association between RTA and Sex. It was found to be statistically significant (P value is 0.0255).

Fisher's Exact test was performed to see the association between physical assault, sports, self fall, occupational Hazard and sex. Only physical assault was found to be statistically significant. (P value is 0.0445).

DISCUSSION

Our study correlated with earlier studies done by S E Udeabor et al¹¹ where more than 75% of the study population were males and 68.6% were between the age group of 20-40 years. Male predominance in our study agrees with Garkoti et al where they found male prevalence to be 80.7% and females 19.23%^{12,13,14,15,16,17,18,19}. The overall male to female ratio was 5.2:1 which corresponds to the study done in Zimbabwe (5:1)²⁰ and India (6.3:1)^{10,19,21,22}. Males are commonly involved in driving vehicles, sports, physical aggression. They lead more active social life which can include alcohol and other drug abuse predisposing to severe maxillofacial trauma and other injuries sometimes inevitably leading to death²³.

In the present study the 21-40 (58%) year age group had the highest prevalence of maxillofacial trauma. In the study Cinthura C et al²², 70 % were in the age group of 10-35 years and Guruprasad et al¹⁹ got similar results with 42.5% of young adults in their third decade between the age group 21-30 years. In agreement with other previous studies people in the age group 21-40 years were frequently affected suggesting a common pattern of trauma^{10,24,25,26,27,28}. During the second and third decade of life young adults are more exposed to contact sports, travelling at high speeds and alcohol intake. Older age group are low in their activity reducing the frequency of maxillofacial trauma.

In a developing country like India with improper road conditions, poor road safety awareness, inadequate enforcement of traffic rules, old vehicles, high number of passengers, crossing speed limits and lack of wearing seat belts results in increased frequency of road traffic accidents. Full faced helmets reduce the severity of the maxillofacial trauma as well protect the rider from head injuries²⁸. Similar to other studies we observed road traffic accidents was the most common etiological factor 67.3% for maxillofacial trauma followed by physical assault 13.3% and sports 12%. This correlated with studies done by Abhinav et al (71.4%)²⁸, Sawhney et al (50%)²⁹ and Gali et al (73.6%)²³. Chandra et al observed road traffic accidents as most common etiology of maxillofacial trauma with 12.3% from physical assault and 7.1% from sports injury³⁰.

Gross distribution of maxillofacial trauma showed that nasal bone fracture was the commonest (42.8%) followed by mandibular (28.6%) and maxillary fractures 16%. Nasal bone protrudes out of the facial plane and its central location predisposes to injury. Nasal bone fractures are the most common accounting for 40-50% of cases^{31,32}. Isolated nasal fractures are the most common, they may be associated with zygomatic-orbital-maxillary complex fracture. Zandi et al³³ reported that the nasal bone (63.4%) was the commonest bone to be fractured. In their study Smrity Rupa et al¹⁰ found 26.3% of nasal fractures and was the opinion that the fragile nature of the nasal bone, its projected nature makes it vulnerable for fracture. In review of literature the condyle is the most commonest site of mandibular fracture. It is a protective mechanism in order to prevent the transmission of the force of injury to the middle cranial fossa and base of skull. Our study is in agreement with most previous studies that condyle 36.5% was the most common site of mandible fracture and ramus being the least site of fracture³³. Among the maxillary fractures LeFort II was the commonest which is in consistency with other studies by Motamedi et al³⁴. However some investigations have reported that LeFort I fractures is greater than that of LeFort II and III³³. Though the zygoma is a strong bone due to its protruding position and adjacent weaker bones make it vulnerable for fractures. In the study by Schultz et al³⁵ frontal sinus fracture constitute 5-15% of all facial bone fracture. Frontal sinus bone fracture was 1.1%, and least involved bone in our study.

The aim of maxillofacial trauma treatment is reducing the displaced and fragmented bone and restore the function and esthetic aspects of

an individual. In our study 46% of the nasal fractures were managed conservatively while the rest 54% were managed by external nasal splints after reduction. 57% of patients with mandible fractures underwent open reduction and internal fixation while the 43% of the patients were treated with intermaxillary and maxillomandibular fixation. Among the LeForts fracture 86% of them required open reduction and internal fixation while all the patients of frontal fractures were treated by open reduction and internal fixation in consistent with the studies from Chandra L et al who reported 50.80% of patients undergoing open reduction and internal fixation. This finding was in correlation with the observations by Gali et al and Mijiti et al who treated 58.6% and 62.4% with open reduction and internal fixation respectively.

CONCLUSION

The gravity of complexity of maxillofacial trauma needs to be understood. Road traffic accident was the major cause of maxillofacial trauma. The younger age group were affected. Nasal bone fractures were commonly noted. It is of utmost importance to identify the etiology and treatment modality in maxillofacial trauma. Careful consideration should be given to the nature of trauma and anatomical site affected. Maxillofacial trauma varies in severity but management of all injuries follows similar principles keeping in mind regarding the rehabilitation and returning to the normal function. As wisely said prevention is better than cure educating the public regarding the preventive measures needs to be implemented.

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