Pattern of Mandibular Fractures in Motorcycle Crash Victims in a Tertiary Care Hospital

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OBJECTIVE: To determine the frequency and pattern of mandibular fractures due to motorcycle accidents in a Tertiary care Hospital.

METHODOLOGY: A cross-sectional study was carried out on patients visiting the Department of Oral and Maxillofacial Surgery (OMFS), Foundation University College of Dentistry (FUCD), Islamabad, with only mandibular fractures due to motorcycle crash from October 2021 to September 2023. Their detailed history including demography and accidental details were recorded followed by clinical and radiographic examination to aid in clinical diagnosis and detect fractured mandibular subunits.

RESULTS: A total of Two hundred twenty motorcycle accident patients were brought during the study period. Males were predominantly affected as 76.36% and 23.64% were females. The majority 51.36% were aged 21 to 40 years, the mean / SD age of victims was 30.59 ±12.90. Out of all victims 63.64% were riders. Most riders (58.2%) were driving motorbike at a usual speed of 31 - 60 Km/hr. Only 19.05% of male victims were wearing helmets. Most accidents occurred in evening. Majority of victims were having isolated mandibular fractures and Angle of mandible was the commonest type of mandibular fracture.

CONCLUSION: The study identified a diverse range of mandibular fracture types among the patients, which reflect broader trends related to motorcycle accidents. There is a clear need for increased safety measures, including enhanced Helmet Use, Public Awareness Campaigns, Improved Road traffic control legislation.

KEYWORDS: Accidents, Fractures, Mandible, Motorcycle, Trauma

INTRODUCTION

Road traffic crashes result in the deaths of approximately 1.19 million people around the world each year and leave between 20 and 50 million people with non-fatal injuries. More than half of all road traffic deaths occur among vulnerable road users, such as pedestrians, cyclists and motorcyclists.[1] As per the official estimate of WHO data current Road traffic mortality rate (per 100 000 population) in Pakistan is 11.9.[2] However among road deaths worldwide, accidents involving motorcyclists accounted for 9% of deaths in Europe, 20% in the United States, and 34% in the countries of the Western Pacific and Southeast Asia including Pakistan.[3]

Most maxillofacial traumas are caused by motorcycle accidents.[4] Motorcycles are a popular choice of transport due to its affordability, maneuverability, low cost and cheaper maintenance. However they are not a safe vehicle due to its design, balancing issues, absence of safety devices like shield and safety guards.[5] Moreover absence of traffic law enforcement, congested and overcrowded streets increasing the chances of crashes. These findings are also supported by other studies.[6]

Mandibular fractures are quite common although not life threatening, it may results in poorer health outcomes in terms of nutrition and greater injury related disability, sometimes even preventing employment.[7] Analysis of the

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American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database showed that mandible fractures were the most common isolated facial fracture.[8]

Mandibular fractures can occur in various locations depending on the type of injury and the direction of the force involved, and can affect different regions of the mandible.[9] In addition to discomfort and pain they may encounter difficulties with chewing and speaking due to the impaired functionality of the jaw. Additionally, the fracture can result in an esthetic deformity, impacting the appearance of the jaw and potentially affecting the person's self-confidence.[10]

Cochrane review found that wearing a helmet protected against death and head injury with significant odds ratios of 0.58 and 0.31, respectively.[11]

Our rationale was to evaluate patients with mandibular fractures, focusing on motorcycle accidents and providing an epidemiological picture. It also facilitate in suggesting preventive measures to reduce mandibular fractures due to motorcycle accidents.

METHODOLOGY

Study Design
Descriptive Cross-sectional study.

Place of Study
Department of OMFS, FUCD, Islamabad.

Duration of Study
Two year from Oct 2021 to Sept 2023

Sample Size: 220 patients:
Using WHO Sample Size Calculator formula:
$$n = Z^2 p. (1 - p) / E^2$$
- Where:
  - n = Required sample size
  - Z = Z-value (from the Z-distribution corresponding to the desired confidence level)
  - o For a 95% confidence level, $Z=1.96Z = 1.96Z=1.96$
  - p = Estimated proportion (e.g., prevalence of the condition or disease, expected proportion of the population with a certain characteristic)
  - E = Margin of error (the desired precision level, typically expressed as a decimal; for example, $E=0.05E = 0.05E=0.05$ for a 5% margin of error)
    Level of Confidence: 95%

Anticipated Population
16.8% (reference article from which the estimate was derived).[12]
Margin of Error / Absolute precision: 5%

Inclusion Criteria
All Motorcycle crash victim, clinically and radiologically diagnosed cases showing presence of only fracture mandible.
Any facial soft tissue trauma sustained with accompanied mandibular fracture.

Exclusion Criteria
Patient not consenting to participate in the research work. Cases of facial bone fractures, other than mandible.
All facial soft tissue trauma sustained without accompanied mandibular fractures.

Data Collection Procedure
- Approval from institutional Ethical Review Committee (letter no. FF/FUCD/632/ERC-002) Dated 31.05.2021. (Annexure A) Attached
- Written informed consent from patients obtained. (Annexure B) Attached
- All accident details were recorded on a pre-designed proforma.
  (Annex C).Attached.
- Fracture sites were assigned based on clinical and radiographic findings.

DATA ANALYSIS PROCEDURE

- Data was analyzed using SPSS (version 23, IBM Corporation Chicago II, USA)
- Quantitative variables were measured as means and SD, and qualitative variables were controlled by stratification.
- Chi square test was used for post stratification and P-value of 0.05 or less was considered statically significant

RESULTS

Two hundred twenty motor cycle accident patients with mandibular fractures were studied. We found males 168 (76.4%) were predominantly affected as compared to females. Demographic details are presented in Table I.

The pattern of mandibular fracture suggested Angle of Mandible was the commonest site of fracture, followed by Condyle and Alveolar bone (Table II).

Stratification was done between different variable with the counts of fracture mandible (Table III).

On stratification of overall pattern of mandibular fractures, a very small p-value in victims having fracture sites of Angle

Table 1: Distribution of victims in each category

Variables	Categories	Frequency (Percentage)
1. Gender	Male	168 (76.4%)
	Female	52 (23.6%)
2. Age group	8 - 20 years	60 (27.3%)
	21 - 40 years	118 (53.6%)
	More than 40 years	42 (19.1%)
3. Status	Pedestrian	8 (3.7%)
	Pillion passenger	72 (32.7%)
	Bike Rider	140 (63.6%)
4. Speed	0 – 30 km/hr	56 (25.4%)
	31 – 60 km/hr	128 (58.2%)
	More than 60 km/hr	36 (16.4%)
5. Wearing of helmet	No	188 (85.5%)
	Yes	32 (14.5%)
6. Timing	Morning	49 (22.3%)
	Afternoon	63 (28.6%)
	Evening	81 (36.8%)
	Night	27 (12.3%)
7. Severity of fracture	Single fracture	132 (60%)
	Multiple fractures	88 (40%)

Table II: Distribution of victims according to site of mandibular fractures

Site of mandibular fractures	Frequency (Percentage)
Alveolar Bone	60 (18.2%)
Angle of Mandible	80 (24.1%)
Condyle	72 (21.64%)
Parasymphasis	44 (13.24%)
Ramus	12 (3.6%)
Symphysis	36 (10.82%)
Body	28 (8.4%)

Table III: Stratification of Count of mandibular fractures

1. Gender	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	P value
Male	95 (43.2%)	73 (33.2%)	2.140	0.343
Female	35 (15.8%)	17(7.8%)		
2. Status of victim	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	P-value
Pedestrian	8 (3.64%)	0	8.532	0.074
Pillion Rider	44 (20%)	28 (12.73%)		
Rider	84 (38.18%)	56 (25.45%)		

3. Time	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	p-value
Morning	24 (10.9%)	25 (11.36)	10.692	0.098
Afternoon	38 (17.28%)	25 (11.36%)		
Evening	53 (24.1%)	28 (12.73%)		
Night	15 (6.82%)	12 5.45%)		
4. Age	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	P Value
8 – 20 Years	35 15.9	25 11.36	7.362	0.118
21 – 40 years	67 30.46	51 23.18		
More than 40 years	28 12.74	13 .36		
5. Speed	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	P-value
0 – 30 km/hr	26 (11.82%)	24 (10.9%)	11.666	0.020
31 - 60 km/hr	82 (37.28%)	42 (19.1%)		
>60 km/hr	22 (10%)	24 (10.9%)		
6. Use of Helmet	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	p-value
No	115	73	9.465	0.009
Yes	15	17		
7. Severity fracture	Group I (Single #)	Group II (2 or more #)	Chi ^{2}	p-value
Single fracture	130 (59.1%)	0	204.157	0.001
Multiple fractures	0	90 (40.1%)		
Total # sites	130	332	Mean #	1.51/victim

Table IV: Stratification of Count of Fracture with respect to its Site of Fracture

Site of fracture	Group I (Single #)	Group II (2 or more #)	Chi Square	P Value
Alveolar Bone	31	29	25.966	0.0001
Symphysis	12	24	28.349	0.0001
Parasymphysis	16	28	24.595	0.0001
Body	14	14	2.192	0.334
Angle	32	48	19.094	0.0001
Ramus	0	12	23.316	0.0001
Condyle	24	48	30.195	0.0001

of mandible, Condyle, Alveolar bone, Parasymphasis and Symphasis suggests that the observed proportion is significantly different from the anticipated proportion of 16.8%.[12] In other words, there is strong evidence against the null hypothesis that the proportion of such trauma patients is 16.8% (Table IV).

DISCUSSION

In the maxillofacial region the mandibular bone is hardest and second most common site for fractures after the nasal bone owing to its relative protuberance in comparison to rest of the facial skeleton. It ranges from 15.5 to 59% of all the maxillofacial bone fractures.[13]

Our study shows a predominance of male victims with 76.36%, this was in line with other regional studies, by Qazi M. et al,[14] at Hyderabad shows 84.66%, and in Islamabad Asad MH. et al,[15] noted 90.6% with mandibular fractures due to motorcycle accidents. Another study by Moshy JR. et al,[16] in Tanzania shows 90.9%, was also in confirmation with our findings and justified the male predominance due to their frequent participation in driving vehicles, whereas females most often were confined to housework and were less exposed to accidents.

The mean age in our study was 30.49 ±12.90 which was closer to the mean age of 29.5 noted by Qazi M, et al,[14] and 27.34 by Iqbal S.[17] In our study 51.36% were young adults in age group of 21 to 40 years of age, it was closely noted 58.9% by Zulfiqar K,[18] in Lahore and 68% in Tanzania by Moshy JR, et al.[16] Predominance of young male in our study was attributed to their frequent movements hence increasing their chances of being involved in crashes.

A very important and efficient strategy for reducing mandibular fracture / head injuries among motorcyclists is to wear a helmet. Most commonly, three type of helmets were worn by the riders: full-face, which cover the entire head and have a chin bar, open-face helmets are similar to full face except that they do not have a chin bar. The half-helmets cover only the head and may or may not have visors.[7] The lack of protection provided by the open-face and half-helmets explain the high incidence of mandibular fracture in spite of wearing a helmet. This was also noted in our study, all 14.5% of the victims were wearing half helmet at the time of the accident, and none of them were pillion passenger, this was in line with other regional studies as individuals wearing helmet were 12.5% in Peshawar by Ashraf N et al,[19] and 10% by Singh RK,[20] et al. However it was 36% in Hyderabad by Qazi M. et al.[14] Wu et al.[21] has also reported that the full-face helmet offers better protection against facial injury than other type helmet.

According to the outcomes of this study majority (63.64%) of victims were riders, whereas 32.73% were the pillion passengers and only 3.63% were the pedestrians however another study in Egypt by Helal N E, et al,[22] observed 57.1% riders, pedestrians were 28.6% and backseat pillion passenger were only 4.3% and in another study by Noorali et al,[23] 82.4% were the riders and 17.6% were the pillion passengers. It suggest that riders drive cautiously while having a backseated passenger. In our study, most accidents (30.1%) occurred in evening similarly Noorali I S,[23] noted 59.4% and Moshy J R,[16] noted 47.7% during night. This coincide with rush hours due to closure of work places, and possibly tiredness decreased alertness while driving the motorcycles.

In our study most victims did not noted speed but 58.18% claimed that they were driving within speed of 30 -60 km/hr and only 16.36% accepted of driving at an higher speed, similarly Moshy JR,et al,16 noted 64.4% were driving at speed of 30 - 60 km/hr, contrarily Noorali I S, et al,[23] mentioned 54% victims drove at high speed.

Most of the victims in our study (60%) were having single mandibular fractures whereas 40% of patients were having two or more fractures sites however another study by Iqbal S[17] in Karachi observed 30.6% multiple fracture, but Moshy JR,et al,[16] observed 43.18% and 56.82% and Noorali I S et al,[23] observed 42% and 58% of patients having single and multiple mandibular sites fracture respectively.

In our study of 220 patients, reported with 332 sites of mandibular fracture, averaging 1.51 fractures per patient. Angle of Mandible (24%) and Mandibular Condyle (23.44%) were the most common sites of fracture, whereas Iqbal S et al,[17] and Asad MH,[15] found parasymphysis being the commonest site of fracture. Similarly in another study in Venezuela by Amarista Rojas FJ, et al,[24] observed 334 patients with 522 mandibular fractures, almost half of his patients (48%) were having multiple sites of mandibular fractures, averaging 1.56 fracture per patient with parasymphysis was the most common location.

CONCLUSION

The prevalence and types of mandibular fractures observed in this study reflect a clear need for increased safety measures, including: Enhanced Helmet Use, Public Awareness Campaigns and Improved Emergency Response and Treatment. Future Research Directions were needed to explore the long-term outcomes of mandibular fractures resulting from motorcycle accidents, including the impact on dental and mandibular function.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest, and there is no difference of opinion in this research.

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