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Original Article

Incidence and pattern of mandibular fractures in Rohilkhand region, Uttar Pradesh state, India: A retrospective study

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ABSTRACT

Aims: To understand and evaluate the significance of various aetiological factors in determining the incidence and dictating the patterns of mandibular fractures in Rohilkhand region.

Methods: The patient records and radiographs for 144 patients treated for mandibular fractures were reviewed between the time periods from January 2012 to December 2013. Data on age, gender, aetiology, use of intoxicants, head injury, associated injuries, days of the week, anatomic site and multiple fractures within the mandible were recorded and assessed.

Results: Maximum incidence of fractures was observed among the individuals in 3rd decade (35.4%) followed by 2nd and 4th decades, which exhibited 32 and 30 cases (22.2% and 20.8%), respectively. Male to female ratio was biased (4:1) portraying a male predominance. Road traffic accidents (RTAs) were observed to be the predominant aetiological factor responsible accounting for 79.2% of the total injuries followed by assaults (11.8%) and falls (9%). Parasymphysis exhibited the highest incidence (32.63%) amongst the anatomic sites, followed by body (18.75%), angle (16.66%), condyle (15.27%), symphysis (12.50%), ramus (2.77%) and coronoid (1.38%).

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Conclusion: The study reveals that majority of affected patients were in the 2nd and 3rd decades. A definitive relationship existed between RTA and the incidence of mandibular fractures. The frequency further increased with consumption of social intoxicants. The most commonly fractured site was parasymphysis either isolated or associated with other fractures in the mandible.

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1. Introduction

The maxillofacial region is one of the most commonly fractured sites of the body. The management of these fractures is a challenge requiring skill and experience. In repair of maxillofacial trauma, functional and aesthetic reconstruction is a prime concern.¹ These injuries can vary in severity ranging from minor soft tissue injuries to major fractures of the entire facial skeleton. Mandibular fractures may occur alone or in combination with other facial and skeletal bones. The aetiology of mandibular fractures could be caused by road traffic accidents (RTAs), accidental falls, assaults, industrial mishaps, sports injuries and firearm injuries.²

RTA is the leading cause of mandibular fracture in developing countries owing to poor enforcement of law and ensuring the abidance by the existing traffic and speed limit regulations, while interpersonal violence is the leading cause in developed countries.^{3,4}

The Department of Oral and Maxillofacial Surgery at the Institute of Dental Sciences, Bareilly associated with Rohilkhand Medical College & Hospital, with bed capacity of 600 caters to the medical requirements of virtually the entire Western Uttar Pradesh region with a radius of 100–150 km. This is the only tertiary level institute in this region having a well-equipped surgical set-up. Bareilly is situated alongside one of the very busy highways of North India; most of the cases, therefore naturally, were being referred to our centre. Being a teaching cum training institute with an attached multi-bedded hospital, special emphasis is laid upon careful documentation and maintenance of records with a central medical records department. Due to these reasons and also the lack of a reliable study focusing upon these cases reported so very often in this area from a Maxillofacial perspective, need arose of a comprehensive study that could analyze and relate the various patterns and types (The Effect) to the commonly documented aetiological factors (The Cause) and precisely determining as to what extent if at all do these factors contribute in these mishaps.

The objectives of the present study were to record the epidemiology of the mandibular fractures in Rohilkhand region and also to appreciate the importance of demographics, the influence of the social habits and contribution of individual aetiological factors towards such injuries. Moreover, the high prevalence of intoxication amongst the affected population points to the growing necessity of a reliably documented and scientifically backed evidence that could hasten the strict enforcement of road traffic legislation with decongestion of roads and formulation of strict drink-and-drive policies in this

region and also the use of seat belts and safety helmet regulations should be made compulsory.

2. Subjects and methods

The present retrospective study included data collected from total number of 144 male and female patients who had reported to the casualty department of Rohilkhand Medical College and the Department of Oral and Maxillofacial Surgery of Institute of Dental Sciences, Bareilly city, Rohilkhand region in the time period from January 2012 to December 2013. The study protocol was reviewed and approved by the Institutional Ethical Committee and the Helsinki guidelines were followed. All patients were in the 1st to 6th decade of life and having associated/concomitant facial and other skeletal bone fractures were included in the study except patients whose records (case sheets/radiographs or photographs) were found incomplete, patients with severe systemic and multi-organ injuries, financial constraints of the patient, patients who required tertiary centre referral for further management of multi-organ injuries, patients who succumbed to the injuries, and who left against medical advice were excluded. Simple descriptive (univariate analysis) statistics were used to analyze the data by using the Statistical Package for Social Sciences version 15.0 software (SPSS Inc, Chicago, IL, USA).

3. Results

Out of the total sample of 144 patients, 122 (84.7%) were males and 22 (15.3%) were females pointing out to a male preponderance (5.5:1). Majority (35.4%) were in the age group of 21–30 years followed by 11–20 years (22.2%). This shows that the young adults are mostly affected (Table 1).

The RTAs (79.2%) clearly predominated in both genders, being the single largest reported aetiological factor contributing to the majority of mandibular fractures followed by assaults (11.8%) and falls (9%) (Table 2).

A total of 51 cases (35.4%) out of the study population reported the use of intoxicants. A majority used alcohol (58.9%) followed by toddy [local brew from date palms/sugarcane] (33.3%) and 7.8% of patients used Ganja or Opioids (Table 3).

With regard to the frequency of distribution of injuries by the day of the week, Sunday appeared to be the day on which maximum injuries were sustained (30.55%) (Table 4).

Our findings reveal that 50.6% of the patients (73 cases out of 144) with mandibular fractures had associated injuries, out

Table 1 – Distribution of the sample according to age and gender.

Age (in years)	Males n (%)	Females n (%)	Total n (%)
1–10	12 (85.7)	2 (14.3)	14 (9.7)
11–20	27 (84.4)	5 (15.6)	32 (22.2)
21–30	43 (84.3)	8 (15.7)	51 (35.4)
31–40	26 (86.7)	4 (13.3)	30 (20.8)
41–50	7 (77.8)	2 (22.2)	9 (6.3)
51–60	7 (87.5)	1 (12.5)	8 (5.6)
Total	122 (84.7)	22 (15.3)	144 (100)

Table 2 – Comparison of aetiology for trauma according to gender.

Aetiology of trauma	Males n (%)	Females n (%)	Total n (%)
Road traffic accidents	100 (87.7)	14 (12.3)	114 (79.2)
Falls/Fall from height	8 (61.5)	5 (38.5)	13 (9)
Assaults	14 (82.4)	3 (17.6)	17 (11.8)

Table 3 – Use of various intoxicants in the study population.

Type of intoxicant	Males n (%)	Females n (%)	Total n (%)
Alcohol	30 (60)	0 (0)	30 (58.9)
Opioids/Ganja	4 (8)	0 (0)	4 (7.8)
Toddy	16 (32)	1 (100)	17 (33.3)
Total	50 (98)	1 (2)	51 (100)

Table 4 – Distribution of cases based on the days of the week.

Day of the week	Numbers	Percentage
Sunday	44	30.55
Monday	16	11.11
Tuesday	13	9.03
Wednesday	9	6.25
Thursday	11	7.63
Friday	15	10.41
Saturday	36	25

Table 5 – Associated injuries reported in the study population.

Type of injuries	Number	Percentage
Head injury	31	21.6
Le Fort III	4	2.77
NOE fracture	1	0.69
Le Fort II	10	6.94
Le Fort I	3	2.08
ZMC	6	4.16
Cervical injury	1	0.69
Clavicle	9	6.24
Rib	2	1.38
Radius	2	1.38
Femur	3	2.08
Fibula	1	0.69
Total	63	48.67

of which head injury accounted for the greater majority of the associated injuries (21.6%) (Table 5).

Based on the anatomical site, parasymphysis fractures (32.63%) were most common followed by body (18.75%), angle (16.66%) and condyle (15.27%) (Table 6).

Amongst combination fractures (2 fractures), the most prevalent were parasymphysis with angle constituting 6 out of 144 (4.16%). This was followed by symphysis with condyle in 5 cases (3.47%), parasymphysis with condyle in 4 cases (2.77%), parasymphysis with body in 3 cases (2.08%), angle with condyle in 2 cases (1.38%), followed by bilateral parasymphysis in 5 cases (3.47%), bilateral angle in 3 cases (2.08%), bilateral condyle in 2 cases (1.38%), and even in multiple fractures sites (more than two fractures in the mandible) parasymphysis was the most commonly involved site (Table 7).

4. Discussion

The aetiology and incidence of mandibular fractures vary with geographic region, socioeconomic condition, cultural characteristics and era.⁵

The incidence of mandibular fractures in our study found that majority of the reported cases fall between the age group 21–30 years (3rd decade, 35.4%) followed by 2nd (22.2%) and 4th decade (20.8%). The second, third and fourth decades constitute the most active periods of a persons' life. The results of our study are in accordance with other published data.⁶ In contrary

Table 6 – Distribution of fractures based on anatomic site.

Type of fracture (based on anatomic site)	Number of cases	Percentage	Isolated cases	Associated with other fracture in mandible	Bilateral (same anatomical location on the contralateral side)
Parasymphysis	47	32.63	24	18	5
Body	27	18.75	22	5	0
Angle	24	16.66	8	13	3
Condyle	22	15.27	2	18	2
Symphysis	18	12.50	10	8	0
Ramus	4	2.77	4	0	0
Coronoid	2	1.38	1	1	0

Table 7 – Combined fractures (two, three and four) in mandible.

Sites involved	Number of cases	Percentage (of total)
Parasymphysis + Angle	6	4.16
Symphysis + Condyle	5	3.47
Parasymphysis + Condyle	4	2.77
Parasymphysis + Body	3	2.08
Angle + Condyle	2	1.38
Symphysis + Angle	1	0.69
Body + Condyle	1	0.69
Parasymphysis + Coronoid	1	0.69
Bilateral Parasymphysis	5	3.47
Bilateral Angle	3	2.08
Bilateral Condyle	2	1.38
Parasymphysis + Angle + Condyle	3	2.08
Symphysis + Bilateral Condyle	2	1.38
Parasymphysis + Body + Angle + Condyle	1	0.69

to our study 2nd decade was followed by 3rd and 5th decade population which was observed in another study.⁷

In our study, the incidence of mandibular fractures in male subjects were predominant. Out of the total study population of 144 cases, 122 cases (84.7%) were males and 22 were females (15.3%). The majority of the reports published during the new millennium have shown male preponderance ranging from 68% to 91.7%. Our study is in accordance with other published data.^{8,9} The male predominance is suggested by their more aggressive, dominant and outgoing persona as prevalent in the Indian community. Rohilkhand region being a large, yet non-metropolitan region in Uttar Pradesh state, females are reserved and mainly deal in the household affairs, thereby remaining predominantly indoors and are consequently less exposed to the aetiological factors leading to mandibular fractures.

According to our study, RTA was the most frequent aetiological factor, accounting for 100 out of 144 cases (69.4%) constituting male patients which are in line with other studies.^{9,10} The high incidence of RTA observed in this zone was probably due to the lack of strict traffic rules and regulations, bad conditions of the roads, and non-compliance with the existing legislations and enactments. Recent epidemiological figures highlight a decreasing trend of maxillofacial injuries due to MVAs, mainly in developed countries.⁴ Increased safety precautions prevalent in other parts of the world are added safety features like deployable airbags, Antilock Braking System (ABS) with Electronic Brakeforce Distribution (EBD), now routine in most of the vehicles. This trend may be explained by a combination of factors that include better road conditions, better car safety features such as air bags, increased traffic control by police and the introduction of laws related to drunk driving, speed limits and seat belts.¹¹

The second aetiological factor being reported in our study is assaults in 17 cases out of 144 (11.8%). Our study is contrary to the results of Vyas et al.,¹² who have reported falls as the second most common cause for the mandibular fractures. This difference might be a reflection of the causative factors.

Drug and alcohol abuse, possession of firearms, which is a part of cultural life in this region, lengthy and expensive judicial proceedings force people to settle matters outside courts frequently leading to grave outcomes. The western

countries have exhibited an increase in shift towards assaults being the dominant aetiological factors for mandibular fractures. Sojat et al.¹³ in 2001 investigated the incidence, causes and treatment of mandibular fractures at a Toronto General Hospital in Toronto from 1996 to 2000. Most of the fractures were caused by violent assaults (53.5%), followed by falls (21.5%), sports activities (12.2%) and Trauma (6.1%).

The third major aetiological factor is fall from height, i.e. 13 out of 144 cases (9%). The majority of the cases in our study were observed in the 1st and the 6th decade. Children above 5 years of age become more independent and begin to have more contact with the surrounding environment. They attend school and begin practicing sport and recreational activities such as bicycling.¹⁴ Usually in the sixth decade of life, as a result of physiological consequences of ageing, cardiovascular and neurological diseases and the use of psychotropic drugs prevail in this age group.¹¹ Hussain et al.¹⁵ reported that the elderly are more likely to be injured as pedestrians owing to poor proprioception, weakness, tremor, impaired reflexes and failing vision, which makes this age group, the elderly, particularly prone to falls and motor vehicle accidents.

In our study, we have not come across mandibular fractures related to sports injuries except for dentoalveolar and teeth fractures. Rohilkhand region being an educational hub caters to many schooling institutions and colleges, but the reported injuries by us have not comprised of sports injuries; the reason for the same being the increasing trend amongst the newer generation parents to report to their relatively more familiar private dental practitioner in the event of such a mishap.

In our study population, 51 out of 144 (35.41%) patients were under the influence of one amongst the many intoxicants prevalent in the Rohilkhand region. The majority, i.e. 30 out of 51 cases (58.9%), were under the influence of alcohol, while 17 cases (33.3%) were under the influence of Toddy that is a locally brewed alcohol based beverage obtained from date palm/sugarcane trees. A small proportion of patients (7.8%) used Ganja or Opioids due to widely prevalent illegal cultivation of poppy plants in Rohilkhand region. Most of the practices were observed in males (98%). This is in accordance with Oikarinen et al.,¹⁶ which accounts about 44%, whereas the study conducted in Nigeria, alcohol was associated with only about 20% of jaw fractures, a proportion significantly lower than reported elsewhere.¹⁷

It is the common experience of the surgeons training maxillofacial injuries that a high proportion of our patients are under the influence of alcohol/intoxicants at the time of admission into the hospital. Such patients are seldom fully conscious at the time of presentation and might even be unconscious. Being under the influence of alcohol at the time of presentation their sensory responses may not be sharp and poor Glasgow Coma Scale (GCS) scores might influence the GCS scores on casual examination. Especially influenced is the recollection of events immediately around the events that led to the trauma. Another undesirable outcome of heavy drinking might be vomitus complicating the airway management. It is frequently due to gastritis as a direct effect of alcohol on gastric mucosal lining and might be a confounding factor for the vomitus influenced by triggering of Chemotactic Trigger Zone (CTZ) on alteration of intra-cranial pressure upon head injury which is of high significance in case of primary assessment of

the extent of head injury. Impaired motor coordination as a direct consequence of alcoholism leading to RTA has been substantiated by numerous studies on the subject revealing statistically significant correlation between the incidence of Maxillofacial Trauma and alcoholism.¹⁸

Head injury was observed in 21.6% in our total patients. There is a high incidence of head and cervical spine injuries associated with maxillofacial trauma in RTA victims. This is due to the fact that when a forward moving vehicle is brought to an abrupt halt, the unrestrained occupants will be thrown upwards and forwards until their movement is arrested by some part of the vehicle, or if they are forcefully ejected from the vehicle on contact with the ground or other objects. The head may come in contact with the windscreen or the roof of the vehicle and thus absorb maximum energy of the impact.

According to Khan et al.¹⁹ in 2011, the most commonly involved site of mandibular fracture in patients with and without head injury was parasymphysis followed by condyle. This is in accordance with our study. In contrast to this, Hung et al.¹⁹ showed that the body/angle is the region with the highest rate of fractures. Czerwinski et al.²⁰ revealed that in the positive head injury group, the majority of patients (54.5%) sustained single mandibular fracture while in the negative head injury group, the majority of patients (51.6%) sustained double fractures. It has been hypothesized that when the mandible sustains fewer fractures, the dissipation of energy is reduced and more force is transmitted to the cranial vault, thereby resulting in a higher incidence of loss of consciousness. Multiple fracture patterns likely serve as a neuroprotective mechanism, allowing greater dissipation of forces and resulting in less residual energy to be transmitted to the cranial vault.

Our findings reveal that 63 out of 144 cases (48.7%) with mandibular fractures had associated injuries. Head injury accounted for the greater majority of associated injuries (21.6%). The incidence of head injury in this study may have been influenced by the non-enforcement of seat belt and motorcycle helmet legislations in Rohilkhand region. This was followed by 10 cases of Le Fort II (6.94%), clavicle (6.24%), Zygomatico Maxillary Complex (4.16%), Le Fort III (2.77%) and Femur and Le Fort I (2.08% each). Varying frequency of associated injuries in Maxillofacial trauma reported by Ugboke et al.¹⁷ was 81.3%, Adakeye²¹ 46.7%, Obeukwe and Etetafia²² 44.2%, Roccia et al.¹¹ 23.2%, Oji²³ 23% and by Down et al.²⁴ was 16%.

In this study, the occurrence of injuries when compared to the other days of the week, Sunday (30.55%) was found to be most common day followed by Saturday (25%). Remaining 64 cases (44.4%) reported between Monday and Friday. Weekends appear to be the days on which maximum injuries were sustained, which could be attributed to a plethora of causative factors such as increased frequency of travel due to social reasons and higher probability of intoxication due to leisure activities on event of a holiday. Khadka and Chaurasia,²⁵ in 2014, have reported Friday as the day of the week with maximum prevalence of maxillofacial trauma, whereas Kapoor and Kalra²⁶ have reported that Saturday and Sunday were the days of the week with the reported maximum number of maxillofacial trauma. Our results are consistent with the findings of the later authors.

The most common sites of fracture in the mandible in this study in descending order were parasymphysis 47 (32.63%),

body 27 (18.75%), angle 24 (16.66%) and condyle 22 (15.27%). The results of Vyas et al.¹², and Ajmal et al.²⁷ were similar to the results of our study. In contrary to our study, the other commonest sites involved in mandible as reported by other authors are symphysis,^{28,29} mandibular body,³⁰⁻³³ angle,^{34,35} and condyle.^{36,37} The difference might be a reflection of the causative factors.

In our study, we observed that out of 144 mandibular fractures, single fracture (isolated fractures) in mandible was reported (49.30%). Amongst combination fractures (2 fractures in the mandible), we observed that parasymphysis was commonly associated with angle (6 cases), which is in accordance with the report by Dongus and Hall,³⁴ and in contrary to our study, Ogundare et al.³⁵ have reported that body with angle as the most common combination. Next most common combinations were symphysis and condyle (5 cases) followed by parasymphysis and condyle (4 cases), parasymphysis and body (3 cases), angle and condyle (2 cases). Among multiple fractures (more than two fractures in the mandible) were reported in 6 cases.

In our study of 144 cases, bilateral fractures (same anatomical location on the contralateral side) were reported in 10 cases in which, bilateral parasymphysis were seen in 5 cases, followed by bilateral angle in 3 cases and bilateral condyle, in 2 cases.

Several different approaches were used for the treatment of mandibular fractures. Out of 144 cases in 109 cases (75.69%), open reduction and internal fixation were done using plates and screws. Out of the remaining 35 cases (24.31%), 27 cases (18.75%) were treated conservatively using maxillomandibular fixation (MMF) and the remaining 8 cases (5.56%) were treated by using circummandibular wiring, particularly in paediatric trauma cases.

5. Conclusion

From our study, the aetiology, pattern and distribution amongst 144 cases of mandibular fractures in Rohilkhand region, we have concluded that mandibular fractures occur in people of all ages, RTA being the chief cause of such injuries. The highest incidence of mandibular fractures was observed in 2nd and 3rd decade of life and that the parasymphysis was the most commonly involved site. Maxillofacial trauma may coexist with other injuries and conversely injuries elsewhere may exist in patients with maxillofacial trauma. So it is necessary for the maxillofacial surgeon to be a part of multidisciplinary trauma team. Furthermore, the results of our data will be helpful for the government agencies and health care professionals towards planning future programmes on prevention.

Key messages

A definitive relationship existed between RTA and the incidence of mandibular fractures. The frequency of RTA further increased with consumption of social intoxicants. The most commonly fractured site was parasymphysis either isolated or associated with other fractures in the mandible.

Conflicts of interest

The authors have none to declare.

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