

Original Article

Epidemiological Study on Mandibular Fracture and Its Association with Anatomical Location Presenting to Emergency Department

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Background : Emergency Department (ED) is usually crowded with sick patients. Assessment of patients suffering from trauma starts with primary and secondary survey to look for life threatening injuries. Management of these patients within the Golden hour (first 60 minutes of post trauma) has reduced mortality and morbidity. But there are challenges to their management and one such challenge is maxillofacial injuries, which can be easily missed by ED physician. Mandibular fracture comprises 15.5 to 59% of facial fractures and despite its importance; there is a scarcity of studies done with ED perspective^{1,2}. This study aimed to identify fracture patterns in accordance with demographics and mechanism of injury which can assist ED physicians in delivering optimal treatment and can also help to formulate traffic regulation and education creating awareness at college and university levels.

Materials and Methods : This retrospective study was conducted on patients presenting to ED of S Nijalingappa Medical College, Bagalkot, over a period of 5 years (2017-22). Primary and secondary survey with demographic profiles and radiological investigations ordered were assembled and analyzed. Descriptive statistics were calculated by SPSS ver 16 software.

Results : Of 1211 patients with maxilla facial injury 218 had sustained mandibular fractures. Males were predominantly involved (70.6%). Pain and tenderness at the site were found in almost all cases, with face contusion and laceration (66.1%) being most frequent associated injuries. Urban population constituted 77.1% and high incidence was seen in months of July to September (38.1%) and mainly between 8 pm to 8 am (44.5%). Pain and tenderness Road Traffic Accidents (RTA) were most frequent etiology and fracture of parasymphysis (36.7%) was most common irrespective of etiology. Nasal bone fracture (22%) and face contusion (66.1) were common associated injuries.

Conclusion : Young men following RTA was the most frequent etiology of mandibular fracture. Patients complaining of pain, tenderness, facial contusion and lacerations should raise the suspicion of its fracture and considered for relevant radiological investigations. Parasymphysis was the commonest site irrespective of etiology.

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Key words : Mandibular fracture, Trauma, Emergency Medicine.

Maxillofacial injury constitutes a significant portion of visits to the Emergency Department (ED). The mandible is the second most common fracture after nasal bone comprising 15.5%-59% of facial fractures^{1,2}. There is a recent shift in age distribution in mandibular fractures where adolescents and young adults are sustaining such injuries in high numbers.

The prevalence and causes of such injuries vary across countries which are mostly influenced by modern lifestyle with high-speed travel, increased violence in the society, socio-economic status, geographic location and educational status of the

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Editor's Comment :

- Mandibular fractures are a common and significant issue in emergency departments, necessitating focused care.
- Understanding the specific fracture locations helps tailor treatment, improving patient outcomes.
- This study underscores the need for injury prevention and enhanced emergency management for mandibular fractures.

population³. In developing countries Road Traffic Accidents (RTA) is leading cause of mandibular fracture, while in developed countries assault and contact sport injuries are common causes^{4,5}. Alcohol consumption is also an eminent contributing factor but not independent one^{6,7}.

The mandible has a role in speaking, chewing and most the importantly to maintain airway⁸. It is more prone to fracture due to its relative position to skull, which is designed to help as a defense mechanism and thus prevent the transmission of forces to skull and brain⁹. Mandibular fractures consist of fractures of coronoid, symphysis, parasymphysis, angle, trunk,

alveolar and condylar¹⁰. If such injuries are missed in ED it may lead to life-threatening complications like airway compromise and bleeding¹¹.

The mechanism and direction of force transmitted can be extremely helpful in diagnosis. Patients with RTA tend to have multiple fractures of the mandible as compared to assaults who usually sustain single, undisplaced fracture¹². Despite many reports about the epidemiology there is inadequate information about the specific type or pattern of Mandibular Fractures in India and South Asian countries. The aim of this study was to identify patterns of fracture in accordance with demographics and mechanism of injury which can assist ED physicians to deliver optimal treatment to patients presenting with poly-trauma.

MATERIALS AND METHODS

The records of Maxillofacial injury patients who presented to ED of S Nijalingappa Medical College, Bagalkot, Karnataka, India, a Tertiary Care Hospital, from June, 2017 to June, 2022 were retrieved from hospital data base. A retrospective analysis was conducted where among 1211 patients presenting with facial injuries 218 had sustained mandibular fractures. The data of these patients were assembled which included primary and secondary survey at ED along with age, sex, mechanism of injury, seasonal variation, number and radiological investigation (CT scan and X-rays) determining the anatomical location of the fractures were collected. Those patients who left against medical advice or whose records were incomplete/missing were excluded from the study.

Statistical analysis was done by SPSS ver 16 statistical software (SPSS Inc, IBM company, New York, US) and the descriptive statistic was used.

Ethical Clearance :

The Institutional Ethics Committee of S. Nijalingappa Medical College & Hospital has approved the Research work proposed to be carried out at S. Nijalingappa Medical College. Date: 16 th June 2022 with Reference no SNMC/IECHSR/2021-22/A-69/1.2

RESULTS

Of 1211 patients who presented to ED with pan facial injuries, 218 had some form of mandibular fractures (18%) in which 154 patients sustained single fracture (70.6%) and 64 patients had multiple fractures (29.4%) of the mandible. The total number of fractures was 351; with mean number of fractures per mandible was 1.6. Patients age ranged from 14 to 78 years, with 154 men (70.6%) and 64 women (29.4%). The highest incidence was in the age group of 20-39 years (42.7%), followed by 40-59 years (29.9%), urban

populations constituted 77.1%, higher incidence (44.5%) was between 8pm to 8am and the injuries were frequent between July to September (38.1%). (Table 1).

The most frequent cause of Mandibular fracture was RTA (65%) followed by falls (17%), assault (10%), sports (6%) and miscellaneous (2%) which included animal bites, gunshot injuries, dental extraction etc. RTA was the most frequent cause irrespective of the gender [males (74, 48.1%), females (29, 45.3%)](Fig 1).

Pain and local tenderness were the most common presentation to ED (100% and 93.6% respectively) with an average pain score of 6. Other findings included malocclusion (77.1%), limited mouth opening (60%) and surgical emphysema (2.8%)(Table 2).

Out of the 351 fractures of mandible, parasymphysis was the most frequent anatomical location (36.7%) followed by the angle of mandible (16.8%). Coronoid fractures were found to be rarest (1.1%) irrespective of the etiology. When fractures are subdivided as per etiology, parasymphysis fracture was most common in RTA (47.8%), condyle fracture (41.7%) in falls and angle (40%) in assault, and 33.3% in sports injuries (Table 3).

Nasal fractures were the commonest concomitant injuries (48, 22%) and face contusion with laceration being the frequent associated soft tissue injury (144,

Table 1 — Demographic Profile of Mandibular Fracture

Demographic Variables	n	n%
Age :		
0-19 years	24	11
20-39 years	93	42.7
40-59 years	65	29.8
>60 years	36	16.5
Sex :		
Male	154	70.6
Female	64	29.4
Residence :		
Urban	168	77.1
Rural	50	22.9
Time :		
8am – 2pm	52	23.9
2pm – 8pm	69	31.6
8pm – 8am	97	44.5
Season :		
January - March	33	15.1
April - June	61	28
July – September	83	38.1
October - December	41	18.8

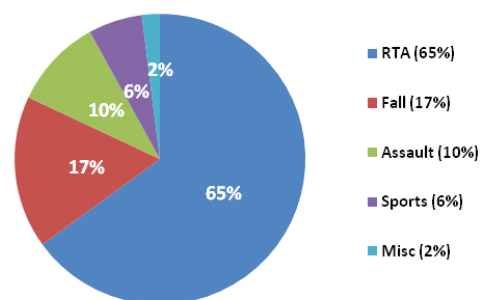


Fig 1 — Distribution of Mandibular Fracture according to etiology

Signs and Symptoms	n (%)
Pain	218 (100)
Malocclusion	168 (77.1)
Limited mouth opening	131 (60)
Tenderness	204 (93.6)
Paresthesia	18 (8.3)
Crepitation	59 (27)
Edema	77 (35.3)
Facial assymetry	41 (18.8)
Hematoma	61 (28)
Surgical emphysema	6 (2.8)

66.1%). Life-threatening complication like airway compromise was found in 2.8% of patients, mainly seen in patients with high-speed motor vehicular accidents (Table 4).

DISCUSSION

One of the concerns in traumatic patients arriving to ED is Maxillofacial fractures¹³. Failure to identify the underlying Facial fractures during primary and secondary survey can lead to difficult airway management especially with procedures like orotracheal intubation. Other complications like facial asymmetry and restricted mouth opening can also be seen. Thus identifying and ordering appropriate investigation with early initiation of treatment in ED is essential for early recovery¹⁴. This retrospective analysis was undertaken to review the incidence, study the etiological factors correlating with anatomical location of the fracture along with associated injuries.

The highest incidence was observed amongst 20-39 years of age group (42.7%), with male predominance (70.6%) and it also coincides with previous reports^{1,15-17}. This can be explained as second and third decade of life is most active period and men usually being involved in most of the outdoor activities.

Male to female ratio of 2.4:1 was found in our study and 5.1:1 in a study by Subhashraj, *et al*¹⁸. If Male to female proportion is considered as an indirect index for social engagement, this increased proportion in

Associated Injuries	n (%)
Associated fractures :	
Maxilla fracture	22 (10.1)
Zygomatic fracture	30 (13.8)
Nasal bone	48 (22)
Base of skull fracture	15 (6.9)
TMJ Dislocation	4 (1.8)
Soft tissue injury :	
Lip laceration	65 (29.8)
Face contusion and laceration	144 (66.1)
Laryngeal injury	6 (2.8)
Vision loss	5 (2.3)
Nasal Septal hematoma	12 (5.5)
Complication :	
Airway compromise	6 (2.8)
Aspiration of tooth	2 (0.9)
Alveolar or mental nerve injury	2 (0.9)
CSF Leak	1 (0.5)
CSF Rhinorrhea	1 (0.5)
CSF Otitorhea	0 (0)

female mandibular injury could be attributed to high mobility and social engagement of females especially in towns and cities where women empowerment and equal opportunities have slowly begun shifting the previous norms of work culture. Thus we can expect increase in likelihood of such injuries among females in developing societies, but this is not the sole reason.

Incidence is higher in urban population (77.1%) which may be due to rapid urbanization and high population in cities. In developing countries like India bad road conditions with inadequate engineering structures and lesser safety regulations on driving motor vehicles are also contributing factors¹⁹. In months of July, August and September more than one third of fractures are witnessed, (38.1%), similar to Johnson *et al*²¹, which can have to do with monsoon seasons leading to slippery roads, low visibility and inability to judge potholes on roads causing road traffic accidents and falls among pedestrians. Higher incidence was observed between 8 pm to 8 am, also supported by other studies²⁰ which can be due to reckless driving, unauthorized speeding, road rage by youths, low

visibility, and absence of traffic police at junctions.

There is a distinct contrast in the etiology of mandibular fractures where RTA is the most common cause in developing countries, like India, whereas assault in developed nations. These findings

Site of Fracture	Etiology											
	RTA		Fall		Assault		Sports		Others		Total	
	n	n%	n	n%	n	n%	n	n%	n	n%	n	n%
Body	20	8.8	2	3.3	4	11.4	2	9.5	0	0	28	8
Angle	29	12.7	8	13.4	14	40	7	33.3	1	14.3	59	16.8
Symphysis	25	11	6	10	1	2.9	1	4.8	0	0	33	9.4
Parasymphysis	109	47.8	8	13.3	7	20	3	14.3	2	28.6	129	36.7
Condyle	26	11.4	25	41.7	1	2.9	0	0	1	14.3	53	15.1
Ramus	11	4.8	4	6.7	3	8.6	4	19	0	0	22	6.3
Dentoalveolar	7	3.1	5	8.3	4	11.4	4	19	3	42.8	23	6.6
Coronoid	1	0.4	2	3.3	1	2.8	0	0	0	0	4	1.1
Total	228 (65)		60 (17)		35 (10)		21 (6)		7 (2)		351 (100)	

are in line with other studies and reports from WHO^{18,22}. Higher incidence in developing countries is due to surge of motorcyclist population, where majority of motorcycles are unsafe, lacking strict norms for active and passive safety measures in them. The rise of motorcyclists in India is due to the post pandemic effects with restricted use of public transportation, low cost to maintain a motorcycle and availability of rental bike in cities making them popular choice of transit. Lack of safety equipment like full cover helmet, gloves, shoes and elbow/knee straps further adds to the danger of mandibular fractures in patients with RTA.

Falls was second common cause for mandibular fracture in our study. India being an agricultural land, fall from trees, like coconut and areca nut are common. Other causes of falls were slip from stairs and in bathroom, especially in geriatric population who are easily susceptible to fractures²³. Assault constituted only a fraction of cases which could be due to social inequality and alcohol/drug abuse, such cases usually go undocumented due to patient's fear of medico legal procedures and involvement of police^{6, 24}.

Pain, tenderness and limited mouth opening are important presentations at ED which will help to identify the underlying mandibular fractures. Similar results were found in other studies as well^{25,26}. The pain score assessment helps to appropriately manage pain. Numeric pain rating scale range from 1 to 10 and are classified as score of 1-3 as mild, 4-6 moderate and 7-10 as severe pain²⁷. In our study 6 was the common score reported by the patients, and appropriate analgesics, Acetaminophen (1000mg) and Diclofenac (75 mg) via intravenous routes, were commonly used for patients with moderate pain score. Rare presentations like surgical emphysema were found in 6 patients, who also had underlying tracheal injury with airway compromise. There is a scarcity of studies on ED presentation of mandibular trauma and thus needs more insight.

The commonest fracture site, irrespective of etiology, in our study was parasymphysis 36.7% consistent with Lin, *et al*⁸. When classified as per site and etiology of fracture parasymphysis was frequently involved in RTA, while falls resulted in condylar fractures and assault patients sustained fracture in angle of mandible. These variations are related to direction and magnitude of force, nature of objects causing injury and patient factors. For example symphysis and parasymphysis being the most prominent part of the mandible, are vulnerable in motorcyclist who are not wearing helmet or wearing only a Half-face helmet. Condylar fracture is involved

when direct blow to chin from the front like in steering wheel injury, especially in cars lacking air bags and seat belt pretensioner as a standard safety²⁹. Such type of figures is barely reported in the literature. Other reason for parasymphysis fracture are due to length of canine roots leading to weakening of the structure and mandible having an arch type of architecture where force is usually distributed along its length and rarely along the curved edges.

Nasal bone, Zygomatic and maxillary fractures were most prevalent with Mandibular fractures, whereas dreaded complications like airway compromise are rarely seen, even supported by other studies²³.

Mechanism of injury has significant correlation with anatomical location of the fracture and knowledge of these associations is of great importance at ED which guides in appropriate management and imaging of patients with facial injuries.

CONCLUSION

The majority of people suffering from Mandibular fracture were young men of working age following road traffic accidents. The etiology is closely linked with anatomical location. A fracture found at parasymphysis should raise a suspicion of RTA, angle involvement in assault and condyle to that of a fall. Thus ED physicians should always have a keen observation on primary and secondary surveys to look at signs like pain, tenderness, and limited mouth opening suggesting maxillofacial injuries in trauma patients.

There is a dire need for traffic regulation on motor vehicles and epidemiological study like ours can help in formulation of education programs at college and university levels for young adults, creating awareness about the importance of adherence to traffic rules and motorcyclists should be emphasized in road safety programs to use of full-face helmet.

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