

# Maxillofacial Fracture Patterns in Road Traffic Accidents

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## Abstract

**Objective:** The objective of this study is to analyze the maxillofacial fracture pattern from road traffic accidents (RTAs) in cases treated surgically in a tertiary hospital during July 2008–June 2018. **Materials and Method:** Data available in the department of oral and maxillofacial surgery of the institution of patients with maxillofacial fractures sustained due to RTAs that were treated in the department between the period July 2008 and June 2018 were collected and analyzed. The variables analyzed for the study were etiology, gender, age, and type of fracture. All cases were treated by open reduction and rigid internal fixation. **Results:** A total of 348 patients with maxillofacial fractures were diagnosed, of which 335 were male and 13 were female. The ages ranged from 7 to 70 years. The maximum cases were in the age group of 16–30 years with 181 fractures followed by 31–45 group with 133 fractures, 45–60 years with 21 fractures, 0–15 years with 8 fractures, and >60 years with five fractures. The maximum incidence of fractures was in the mandible with 168 cases followed by 92 in zygomatic complex, combination of fractures in 53 cases, 13 LeFort I fractures, nine frontal bone fractures, three fractures in other areas, five nasal fractures, and five LeFort II fractures. Males predominated the cases of mandibular fractures involving multiple sites and cases involving multiple bones. **Conclusion:** A maximum number of maxillofacial fractures cases were in the second and third decades of life, and the high-speed vehicles and lack of protective safety accessories such as helmets and seatbelts were responsible for the wide variety of pattern fractures of facial bones.

**Keywords:** Fracture, mandible, road traffic accidents, zygomatic complex

## INTRODUCTION

Maxillofacial injuries resulting from road traffic accidents (RTAs) are one of the leading causes of hospital admissions in India. The combination of a large population using two wheelers, bad condition of the roads, lack of following safety precautions such as helmets and seat belts, and lack of enforcement of the safety rules all add up to a substantial number of facial fractures from RTAs.<sup>[1]</sup>

While a lot of the cases reporting to casualty due to RTAs are lacerations due to fall from two-wheelers or hitting the dashboards in four-wheelers, maxillofacial fractures form the major chunk of cases reporting due to RTAs. In today's scenario, the high speed of the vehicles has led to the classic pattern of fractures seldom being a common finding due to the high-impact forces that cause these fractures.

The unique nature of the facial skeleton in the close articulation of small, fragile bones interspersed with the thick cortical struts also contributes to the multiple fracture pattern in this region.<sup>[2]</sup> The predominance of males as two-wheeler riders is

also highlighted by males dominating the population involved in maxillofacial injuries.<sup>[1]</sup>

The consequences of this needs to be taken into consideration as they are associated with morbidity, including functional loss, esthetic changes, loss of man-hours by the patients, and the financial burden on these patients for hospital stay and treatment expenses.<sup>[3]</sup>

This study reviewed the epidemiology of maxillofacial trauma in patients treated in the Oral and Maxillofacial Surgery Department of Vydehi Institute of Dental Sciences, Bengaluru, India, during the 2008–2018 period.

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## MATERIALS AND METHOD

This retrospective study was conducted based on the records of patients treated for maxillofacial fractures from RTAs in the institution during a 10-year period, July 2008–June 2018. This is a 1600-bedded tertiary care center with an exclusive maxillofacial surgery unit. Records that were reviewed were radiographs, computed tomography data, photographs, and case summary files of the patients.

The records contained details of patients, including age, sex, etiology, pattern of fracture, and treatment.

Patients were divided into five age groups (0–15, 16–30, 31–45, 46–60, and 61 and above).

## RESULTS

Three hundred and forty-eight patients reported during the period with maxillofacial fractures requiring surgical intervention. Of these, 335 (96.2%) were male and 13 (3.7%) were female.

Of the 348 patients who sustained fractures from RTAs, a majority of them (301; 86.4%) were either two-wheeler riders or pillion riders. An overwhelming number of them [296 patients (98.3%)] were without any headgear during the accident.

### Age

The age of the patients ranged from seven to 70. Most cases of fractures were in the age group of 16–30 years for both sexes: 175 males and six females (52.01%). Of the 175 fractures in males, there were 90 mandibular fractures and 48 zygomatic complex fractures, 24 on the right, 22 on the left, and two bilateral. There were 24 fractures involving multiple bones, four LeFort I, three LeFort II, two frontal bone fractures, and one nasal and three NOE fractures. In six females, three were mandibular fractures, one was zygomatic complex fracture, one was nasal fracture, and one involved multiple bones.

There were 133 patients in the 31–45 years' age group (38.21%), including 130 males and three females. One hundred and thirty males had 58 mandible, 33 zygomatic complex, seven frontal, seven LeFort I, two LeFort II, and 23 fractures involving multiple bones. There were one mandible and two zygomatic complex fractures in three females.

There were a total of 21 patients (6.03%) (20 males and one female) in the 46–60 years' age group. Twenty males had eight mandible, four zygomatic complex, five multiple bone involvement, and one nasal and two LeFort I fractures. One female had one nasal fracture.

There were eight (2.29%) (7 males and one female) patients in the 0–15 years' age group with four mandible, two zygomatic complex, and one nasal fracture in males and one mandible fracture in females.

There were five patients in the age group of above 60 years, including three males and two females (1.43%). Three males

had two mandibular and one zygomatic complex fracture, and two females had one mandibular and one zygomatic complex fracture [Table 1].

### Fracture pattern [Chart 1]

Mandibular fractures were the most common constituting 168 cases (48.27%), including 162 males and six females. The next common fractures were zygomatic complex fractures accounting for 92 cases (26.4%) (88 males and four females). There were 53 cases (14.94%) involving multiple bones of the facial skeleton, most of them involving males (52). There were 13 cases of LeFort I fractures (3.73%) (all males), nine cases of frontal bone fracture in males (2.58%), five nasal bone fractures in three males and two females (1.43%), and five cases of LeFort II fractures (1.43%), all in males. There were three other cases (0.86%) involving the naso-orbito-ethmoidal complex in males.

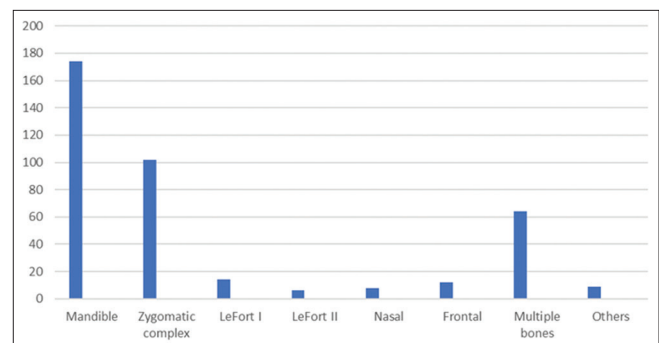
In the 0–15 years' age group, there was primarily an involvement of a single bone.

Of the 168 mandibular fractures, 20 of them involved the condylar region in 19 males and one female including five bilateral fractures. There were 17 angle fractures including three in females; there were 10 fractures involving the body including 1 in females, parasymphysis fractures in 35 males, and six females including five bilateral fractures. When more than one site of the mandible was involved, maximum fractures involved the angle and parasymphysis, all in 42 males. There were fractures of the parasymphysis and condyle in 22 males and three females, including three bilateral condylar

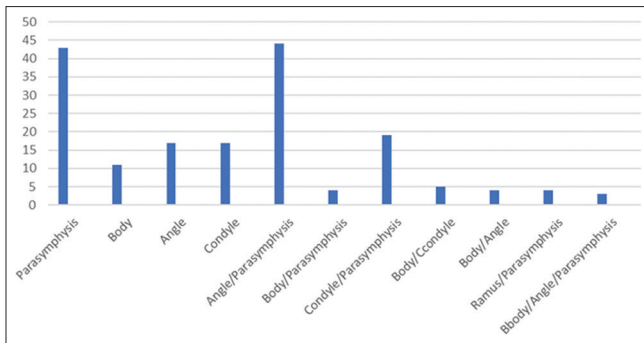
**Table 1: Fracture pattern and age group relation**

Age	0-15	16-30	31-45	46-60	61-
Mandible	5	93	59	8	3
Zygomatic complex	2	49	35	4	2
Nasal	1	2	-	2	-
Frontal	-	2	7	-	-
Multiple bones	-	25	23	5	-
LeFort I	-	4	7	2	-
LeFort II	-	3	2	-	-
NOE	-	3	-	-	-
Total	8	181	133	21	5

NOE=Naso orbito ethmoidal



**Chart 1: Fracture pattern**



**Chart 2:** Mandibular fracture pattern

involvement, nine involving parasymphysis and body in males, and four in the body/condylar region, all in males [Chart 2].

In fractures involving multiple bones, the most common combinations were seen in zygomatic complex/parasymphysis in 21 (20 males and one female), zygomatic complex/condyle/parasymphysis in 14 males, LeFort I/zygomatic complex in 16 males, and zygomatic complex/condyle in two males.

## DISCUSSION

Universally, RTAs have been recognized as a major cause of maxillofacial fractures. Literature from worldwide have shown its preponderance in the etiology of facial fractures. Sawazaki *et al.*<sup>[4]</sup> and Bormann *et al.*<sup>[5]</sup> have shown RTA to be the chief cause of mandibular fractures. Very rarely have other causes contributed to most maxillofacial fractures such as interpersonal violence.<sup>[3]</sup>

The high incidence of RTAs has also been noted in other studies.<sup>[6-9]</sup> There are multiple factors that can explain this large volume of cases involved in RTAs in India, especially a big city like Bengaluru. The density of two-wheelers is very high comprising nearly 60% of the total vehicles on the road. The poor infrastructure of roads, narrow roads, the noncompliance of adopting safety features such as helmets in two-wheelers and not wearing seat belts in cars along with lack of strict enforcement of laws where they exist are responsible for the high incidence of RTAs. Drunken driving by two-wheeler riders is also a significant finding in our study. The number of riders/pillion riders who were fined for not wearing headgear in two-wheelers was nearly 20 lakh, and those jumping the traffic signals were over 6 lakhs in the year 2018 in Bengaluru according to the traffic police statistics. This contrasts with the British study by McGoldrick *et al.*<sup>[10]</sup> who showed a significant decline in RTA as a cause for maxillofacial fractures with time due to stricter enforcement of laws related to safety features and increased awareness.

In most studies, there is a high prevalence of maxillofacial fractures in males. In our study too, there were 335 males of the 348 cases recorded in a 10-year period. This can be explained by the fact that most of the two-wheeler riders are males who show a disinclination to adhere to safety norms and resort to drunken driving, especially in the weekends. The 96.2% incidence of males in our study compares with those of

Arangio *et al.*<sup>[11]</sup> where 83% of the patients sustaining injuries were males.

In general, the younger male population account for most of these fractures. In our study, 181 of the 348 cases of fractures were in the second and third decades of life (16–30 years) accounting for 52.1%. There were very few cases beyond the fifth decade of life (five patients).

A similar 10-year retrospective study by Zhou *et al.*<sup>[6]</sup> showed the maximum incidence in the third and fourth decades of life probably because this group has intense social interaction, has higher rates of mobility, and tend to be more reckless drivers making them more susceptible to injuries. A study from Sharjah has shown maximum fractures in males of the third decade.<sup>[12]</sup>

The fracture pattern in our study was not unique in that mandible was the most common bone involved in maxillofacial fractures. There were a total of 168 cases (48.27%), including 162 males and six females. Very similar findings have been enumerated in most studies.<sup>[13,14]</sup> In contrast, Abdullah *et al.*<sup>[15]</sup> have shown 77.2% of the fractures involving the middle third of the face. In a review of 83 cases in Latino, Lazio, Italy, Arangio *et al.*<sup>[11]</sup> also encountered zygoma as the most common site of fractures.

The next common site of fracture in our study was zygomatic complex fractures that were seen in 92 cases (26.4%) (88 males and four females). Fractures involving multiple bones were seen in 53 cases (14.94%). Significantly, 52 of these cases were in males since most cases involved the male as the driver/rider of the vehicles involved in these accidents. There were 13 cases of LeFort I fractures (3.73%), all in males, nine cases of frontal bone fracture, all in males (2.58%), five nasal bone fractures (1.43%) (three males and two females), and five cases of LeFort II fractures (1.43%), all in males. There were three other cases (0.86%) involving the naso-orbito-ethmoidal complex.

In fractures involving multiple bones, the most common combinations were seen involving zygomatic complex/parasymphysis in 21 (20 males and one female), zygomatic complex/condyle/parasymphysis in 14 males, LeFort I/zygomatic complex in 16 males, and zygomatic complex/condyle in two males.

Specific to the mandible, of the 168 fractures, the most common site of involvement was the parasymphysis with 41 fractures in 35 males and six females, including five bilateral fractures followed by 20 in the condyle region in 19 males and one female including five bilateral fractures. There were also 17 angle fractures including three in females. There were 10 fractures involving the body including one in females. A total of 88 of the fractures involved only a single site. When more than one site of the mandible was involved, maximum fractures involved the angle and parasymphysis, all in 42 males. There were fractures of the parasymphysis and condyle in 22 males and three females, including three bilateral condylar involvement, nine involving parasymphysis and body in males, and four in the body/condylar region, all in males.

Parasymphysis forming the bulk of the mandible fractures is a feature also elicited in the studies of Abdullah *et al.*<sup>[15]</sup>; in contrast, there are many references to the condyle being the most common site of mandibular fractures. Zhou *et al.*,<sup>[12]</sup> Al Ahmed *et al.*,<sup>[13]</sup> Sawazaki *et al.*,<sup>[4]</sup> and Ellis *et al.*<sup>[16]</sup> have all concluded that condyle was the most affected site in mandibular fractures.

## CONCLUSION

This retrospective study of maxillofacial fractures due to RTA treated in a tertiary care hospital in Bengaluru, Karnataka, India, over a 10-year period involved 348 patients. These fractures due to RTAs were not the classic pattern and involved multiple bones and multiple sites in most cases. Open reduction and rigid internal fixation were the best treatment modality in the majority of the cases. The highest incidence of fractures was seen in the second and third decades of life, and most of these could have been avoided if the patients had used safety measures such as helmets and seat belts and adhered to the law of the land.

The severity of facial injuries due to road trauma is usually more than those caused by other factors. Due to the possibility of concomitant injuries in maxillofacial fractures, their management should encompass multiple specialties to provide optimal treatment. The strict enforcement of traffic rules, better road infrastructure, and increased awareness among the population will go a long way in bringing down the incidence.

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## Conflicts of interest

There are no conflicts of interest.

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