

# Characterization of mandibular fractures on computed tomography



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## ABSTRACT

**Background:** With rapid urbanization and motorization of the society there is an exponential increase in road traffic accidents (RTA). Facial trauma and mandibular fractures are some of the common injuries seen in these cases. Imaging of these fractures is essential part of management. Panoramic and oblique X-rays can be used to diagnose these fractures however computerized tomography gives a unique advantage as it enables 3 D reconstructions of images. We conducted this study to assess the patterns of mandibular fractures and associated injuries presenting to a tertiary care center. **Aims and Objectives:** The study was conducted to assess the patterns of mandibular fractures and associated injuries presenting to a tertiary care center in Aurangabad. **Materials and Methods:** This was a prospective study in which 30 cases with complaints of facial trauma and with mandible fractures were included on the basis of a predefined inclusion and exclusion criteria. A detailed history was taken and mode of injury, duration since injury and history of any other trauma was noted down in proforma. Demographic details such as age and gender was also noted down. The CT scan of the face was done. Beam collimation of 2 mm, pitch of 1.2 mm and 120 Kv voltage was used. Patterns of mandibular fracture were analyzed. **Results:** Out of 30 patients there were 27 (90%) males and 3 (10%) were females with a M:F ratio of 9:1. The mean age of male and female patients was found to be 34.96 +/- 10.49 years and 26.66 +/- 5.90 years respectively. Road traffic accidents (RTA) were the predominant causative mechanism and was seen in 27 (90%) of cases. Unilateral multifocal fractures involving body of the mandible were the most common type of fractures. Body of the mandible was seen to have been fractured in 17 (56.66%) cases. **Conclusion:** Mandibular fractures are commonly seen following road traffic accidents. Though X-Rays can be used for diagnosis of these fractures Computerized tomography gives a distinct advantage of ability to do 3-D reformatting of images.

**Key words:** Communitated fractures; Computerized tomography; Traffic accidents; Facial injuries

## INTRODUCTION

With increasing motorisation of society there is an exponential increase in Maxillo-facial injuries and facial injuries are one of the common causes emergency admissions.<sup>1</sup> Mode of injury and direction of the impact is important determinants of location and patterns of these injuries. Mandibular fractures are more frequently multifocal than the unifocal fractures, the most common cause of these fractures in India are road traffic accidents.

The most common site of mandibular fractures includes the body followed by condyle, angle of the mandible and symphyses. Ramus and coronoid process are found to be fractured in minority of the cases. These fractures are classified in open and close types depending upon whether they produce a wound open to the external environment or not. Communitated fractures are those in which mandible is crushed or splintered.<sup>2</sup>

Panoramic radiographs, lateral oblique radiographs, posteroanterior X-ray can be used for the initial diagnosis

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of mandibular fractures however radiographs alone cannot diagnose condylar fractures and hence can miss mandibular fractures.<sup>3</sup> Fractures which were not seen by panoramic tomography can be very effectively evaluated on high-resolution CT particularly fractures involving of angle, ramus, or subcondylar region.<sup>4</sup> Due to high sensitivity for diagnosis of mandibular fractures multidetector computed tomography (CT) has become the mainstay imaging modality for characterization and determining the most appropriate treatment management, fixation method, and deciding surgical approach. The objective of this study was to assess the patterns of mandibular fractures and associated injuries presenting to a tertiary care center in Aurangabad.

## MATERIALS AND METHODS

This study complied with institutional guidelines and was approved by our institutional review board (MGM-ECRHS/Radio/32). Thirty consecutive patients were included in this study. Though the sample size of our study was small it was consistent with studies on mandibular fracture conducted by various authors. Dedicated facial bone CT scan was done for patients who came with complaints of facial trauma and patients with mandible fractures were included in our study and who gave informed and written consent for same. The duration of study was from May 2019 to October 2020. A detailed history was taken and mode of injury, duration since injury and history of any other trauma was noted down in proforma. Demographic details such as age and gender was also noted down. Any previous imaging if available was reviewed. After taking consent Non contrast CT was done in all the cases.

### Scanning protocols

The CT scan of the face was done on Toshiba Aquilion 16 slice CT scanner. Beam collimation of 2 mm, pitch of 1.2 mm and 120 Kv voltage was used. Non contrast thin slice axial CT images were obtained of face and these were then reformatted to coronal and sagittal sections along with reconstructed bone algorithms. 3-D volume rendered images were also obtained. The CT images were analyzed in CT console. The images were analyzed for presence, extent and presence of displacement of fractures. Side by side analysis of coronal and axial images was done. Same senior radiologist assessed all CT images.

Statistical analysis was done using SPSS 21.0 software and p value less than 0.05 was taken as statistically significant.

### Inclusion criteria

1. Patients having mandibular fracture.
2. Age more than 18 years.
3. Written informed consent was obtained from patients.

### Exclusion criteria

1. Age less than 18 years.
2. Those who refused consent.
3. Patients in whom CT was contraindicated such as pregnant patients.

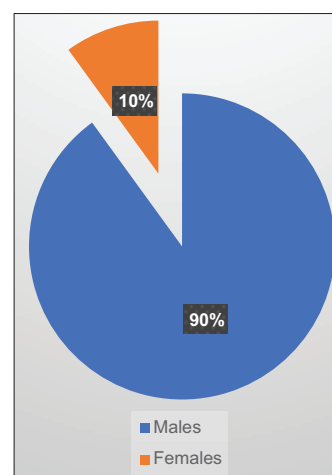
## RESULTS

A total of 30 patients with fracture of mandible were studied. Out of these 30 patients there were 27 (90%) males and 3 (10%) were females with Male: Female ratio of 9:1 (Figure 1).

The most common affected age group was found to be 18-30 years in males as well as female patients. In males out of 27 patients 10 (33.33%) patients were between 18-30 years of age. The other commonly affected age groups were found to be 31-40 years (23.33%) followed by 41-50 (20%) and above 50 years (13.33%) of age. Only 3 females had mandibular fractures. All these 3 patients were young and belonged to age group of 21-30 years (6.67%) followed by 31-40 years (3.33%). The mean age of male and female patients was found to be 34.96 +/- 10.49 years and 26.66 +/- 5.90 years respectively. The mean age of male and female patients was found to be comparable with no statistically significant difference (P=0.193) (Table 1).

Out of 30 cases the most common mechanism of injury was found to be road traffic accident which was found to be the cause of mandibular fracture in 27 (90%) of the cases. Whereas assault and fall was causative factor in 2 (6.66%) and 1 (3.33%) patients respectively (Table 2).

The analysis of patients on the basis of affected side showed that out of studied cases 16 had unilateral (53.33%) and 14 (46.67%) patients had bilateral involvement (Table 3).



**Figure 1:** Gender Distribution of the studied cases

**Table 1: Age distribution of the studied cases**

Age group	No of patients	
	Males	Females
18-30 yr.	10 (33.33%)	2 (6.67%)
31-40 yr.	7 (23.33%)	1 (3.33%)
41-50 yr.	6 (20%)	0 (0%)
>50 yr.	4 (13.33%)	0 (0%)
Total	27 (90%)	3 (10%)
Mean Age	34.96+/- 10.49	26.66+/-5.90

P= 0.193 (Not significant)

**Table 2: Mechanism of mandibular fracture**

Mode of injury	No of patients involved	Percentage
Road traffic accidents	27	90%
Fall	1	3.3%
Assault	2	6.66%
Total	30	100%

**Table 3: Side of fracture in studied cases**

Fracture Side	No of cases	Percentage	
Unilateral	Right	10	33.33 %
	Left	6	20 %
Bilateral	14	46.67%	
Total	30	100%	

In 14 (46.66%) cases there was unifocal involvement whereas in remaining 16 (53.33%) there was multifocal involvement (Table 4).

Majority of the fractures (66.66%) were comminuted type of fractures whereas in remaining 10 (33.33%) patients there was linear fracture (Table 5).

The analysis of specific site of fracture showed that the most common site of fractures were body of mandible (56.67%) followed by condyles (40%) alveolar ridge (36.67%) and Parasymphysis (16.67%). Angle (13.33%), Ramus (10%) and coronoid process (3.33%) of mandible were affected in small number of cases. Temporomandibular joint dislocation was seen in 10 (33.33%) patients whereas there was no dislocation in 20 (66.66%) cases (Figure 2).

## DISCUSSION

After reviewing the total cases with radiological evaluation of mandibular fractures, a total of 30 patients were included in the study on the basis of a predefined inclusion and exclusion criteria. In our study males were found to be predominantly affected with a Male: Female ratio of 1:0.11. Chaurasia et al, conducted a study to know the age- and sex-related prevalence of parasymphyseal fracture, fracture of angle, condylar fracture, symphyseal fracture, and coronoid fracture of mandible. In this study also males

**Table 4: Multifocal or unifocal involvement**

Type of involvement	No of patients	Percentage
Unifocal	14	46.66%
Multifocal	16	53.33%

**Table 5: Type of fracture in studied cases**

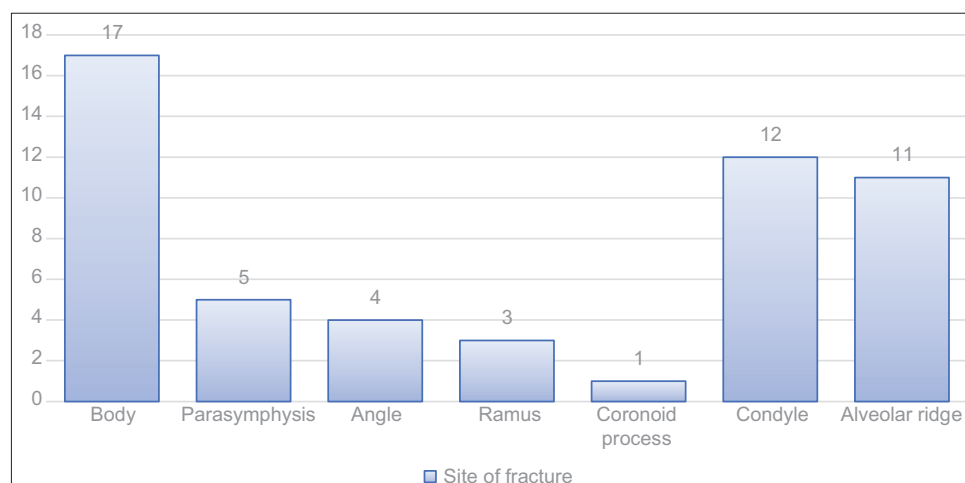
Type of fracture	No of patients	Percentage
Comminuted	20	66.66%
Linear	10	33.33%

were affected predominantly and Male: Female ratio was found to be 4:1.<sup>5</sup> Similar male preponderance in cases of mandibular fractures have also been reported by the authors such as Srinivas MR et al (M:F, 83:15)<sup>6</sup> and Kiran Kumar N et al (Male: Female; 18:2)<sup>7</sup>. Since motor vehicles are predominantly used by men in India predominant affection of males in cases of mandibular fractures is understandable. A study conducted by Samsal et al, observed that men were predominantly involved in motor vehicular accidents in India. The gender distribution in this study was M: F 82%:18%.<sup>8</sup>

The most common affected age group in our study was found to be between 18-30 years. Gadicherla et al, conducted a retrospective study of 689 patients with an aim to evaluate the distribution, etiology and type of mandibular fractures in subjects.<sup>9</sup> The authors found that majority of the subjects were between 21-40 years of age, in both males (61.7%) and females (54.4%). The mean age of the cases with mandibular fractures in this study was found to be 31.54 ± 13.07. This was similar to our study since in our study also most common affected age group was between 20-40 years. Ildirgan K et al<sup>10</sup> and Natsu Set al<sup>11</sup> also reported the mean age of patients with mandibular fractures to be 38.6 and 34.1 years respectively.

In Our study road traffic accident were found to be the predominant cause of mandibular fracture (90%) Whereas assault and fall was causative factor in minority of the cases (10%). Munante-Cardenas in a retrospective study of epidemiological characteristics, surgical treatment methods, and complications of cases involving mandibular fractures found that Road traffic accidents (RTA) caused the most fractures (49.5%), followed by physical violence, including gunshot wounds (21%).<sup>12</sup> In developing countries like that of India Gunshot wounds are not that common as compared to western world and hence in majority of the cases remains road traffic accidents. An Indian study done by Thapliyal et al, found that road traffic accidents were the cause of mandibular fracture in 92% of the studied cases.<sup>13</sup>

In our study majority of the mandibular fractures were unilateral fractures which constituted 53.33% of the studied



**Figure 2:** Site of mandibular Fracture in studied cases

cases. In 16 (53.33%) cases the fractures were multifocal where as in 20 (66.66%) fractures were comminuted. The most common site of fracture in our study was found to be body followed by condyles and alveolar ridge. Rabi et al, conducted a similar study of patients with maxillofacial injuries and found that the Road traffic accident was the predominant etiological factor (63%) and mandibular body was the most common anatomical site of mandibular fractures.<sup>14</sup> Stusy conducted elsewhere reported that mandibular body was the second most common part of mandible to be fractured after parasymphysis of mandible.<sup>15</sup> These findings were similar to findings of our study.

## CONCLUSION

Majority of the mandibular fractures were result of road traffic accidents and were seen in young male patients. In majority of the instances body of the mandible was fractured in our study.

## REFERENCES

- Lee CW, Foo QC, Wong LV and Leung YY. An Overview of Maxillofacial Trauma in Oral and Maxillofacial Tertiary Trauma Centre, Queen Elizabeth Hospital, Kota Kinabalu, Sabah. *Craniomaxillofac Trauma Reconstr.* 2017; 10(1):16-21. <https://doi.org/10.1055/s-0036-1584893>
- Kanno T, Sukegawa S, Nariai Y, Tatsumi H, Ishibashi H, Furuki Y, et al. Surgical treatment of comminuted mandibular fractures using a low-profile locking mandibular reconstruction plate system. *Ann Maxillofac Surg.* 2014; 4(2):144-149. <https://doi.org/10.4103/2231-0746.147103>
- Markowitz BL, Sinow JD, Kawamoto HK Jr, Shewmake K and Khoumehr F. Prospective comparison of axial computed tomography and standard and panoramic radiographs in the diagnosis of mandibular fractures. *Ann Plast Surg.* 1999; 42(2):163-169. <https://doi.org/10.1097/0000637-199902000-00010>
- Dreizin D, Nam AJ, Tirada N, Levin MD, Stein DM, Bodanapally UK, et al. Multidetector CT of Mandibular Fractures, Reductions, and Complications: A Clinically Relevant Primer for the Radiologist. *Radiographics.* 2016; 36(5):1539-1564. <https://doi.org/10.1148/rg.2016150218>
- Chaurasia A and Katheriya G. Prevalence of mandibular fracture in patients visiting a tertiary dental care hospital in North India. *Natl J Maxillofac Surg.* 2018; 9:123-128. [https://doi.org/10.4103/njms.NJMS\\_8\\_18](https://doi.org/10.4103/njms.NJMS_8_18)
- Srinivas MR, Vijay Kumar KR and Vedaraju KS. Spectrum of Mandibular Fractures in Motor Vehicle Accidents: MDCT Evaluation. *JMSCR.* 2016; 4(8): 12003-12014. <https://doi.org/10.18535/jmscr/v4i8.54>
- Kiran Kumar N, Satya Bhushan NVV, Kiran Kumar B, Sudheer A, Prameela S and Patnaik A. A Prospective Randomized Study on Comparison of 2.0mm Non-Locking Titanium Plates versus Locking Titanium Plates (1.8mm and 2.3mm) System for Mandibular Fracture. *JMSCR.* 2017; 5(11): 30435-30443. <https://doi.org/10.18535/jmscr/v5i11.105>
- Sasmal PK, Mohanty CR, Jain M, Radhakrishnan RV, Sahoo S, Krishna VS, et al. The effect of 'THE MOTOR VEHICLES (AMENDMENT) ACT, 2019' on the clinico-epidemiological profile of road traffic accident patients presenting to a tertiary care trauma centre in Bhubaneswar. *J Family Med Prim Care.* 2020; 9(7):3682-3687. [https://doi.org/10.4103/jfmpc.jfmpc\\_293\\_20](https://doi.org/10.4103/jfmpc.jfmpc_293_20)
- Gadicherla S, Sasikumar P, Gill SS, Bhagania M, Kamath AT and Pentapati KC. Mandibular Fractures and Associated Factors at a Tertiary Care Hospital. *Arch Trauma Res.* 2016; 5(4):e30574. Published 2016 Sep 19. <https://doi.org/10.5812/atr.30574>
- Ildirgan K, Zahir E, Sharafi S, Ahmad S, Schaller B, Ricklin ME, et al. Mandibular Fractures Admitted to the Emergency Department: Data Analysis from a Swiss Level One Trauma Centre. *Emerg Med Int.* 2016; 2016:3502902. <https://doi.org/10.1155/2016/3502902>
- Natu SS, Pradhan H, Gupta H, Alam S, Gupta S, Pradhan R, et al. An epidemiological study on pattern and incidence of mandibular fractures. *Plast Surg Int.* 2012; 2012:834364. <https://doi.org/10.1155/2012/834364>
- Cardenas JL, Facchina Nunes PH and Passeri LA. Etiology, treatment, and complications of mandibular fractures. *J Craniofac Surg.* 2015; (3):611-615.

- <https://doi.org/10.1097/SCS.0000000000001273>
13. Thapliyal GK, Sinha R, Menon PS and Chakranarayan A. Management of Mandibular Fractures. *Med J Armed Forces India*. 2008; 64(3):218-220.  
[https://doi.org/10.1016/S0377-1237\(08\)80096-2](https://doi.org/10.1016/S0377-1237(08)80096-2)
  14. Rabi AG and Khateery SM. Maxillofacial trauma in al Madina region of Saudi Arabia: A 5-year retrospective study. *Asian J Oral Maxillofac Surg*. 2002; 14:10-14.  
[https://doi.org/10.1016/S0915-6992\(02\)80015-2](https://doi.org/10.1016/S0915-6992(02)80015-2)
  15. Samman M, Ahmed SW, Beshir H, Almohammadi T and Patil SR. Incidence and Pattern of Mandible Fractures in the Madinah Region: A Retrospective Study. *J Nat Sci Biol Med*. 2018; 9(1):59-64.  
[https://doi.org/10.4103/jnsbm.JNSBM\\_60\\_17](https://doi.org/10.4103/jnsbm.JNSBM_60_17)


**Author's Contribution:**

**BJ** - Concept and design of the study; interpreted the results, prepared first draft of manuscript and critical revision of the manuscript; **NB** - Statistically analyzed and interpreted; reviewed the literature and manuscript preparation; **DD** - Design of the study, statistically analyzed and interpreted, preparation of manuscript and revision of the manuscript; **KM** - Concept and coordination of the overall study.

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