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Original Research Article

# Distribution of Fractures on CT Facial Bones in a Tertiary Hospital in Chennai

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**Abstract:** Facial bone fractures and associated soft tissue injury is common in trauma patients and a quick and accurate diagnosis is essential for timely intervention. Based on the population studied the epidemiology of the fractures seen will vary depending on the type, severity and cause of injury. Computed tomography (CT) is the most common and useful modality for assessing the facial bone fractures. The purpose of this study was to report on the distribution of fractures seen following facial trauma on CT, along with an age wise and gender based distribution in our setup. The study was performed based on the CT findings of facial bone injury in 250 patients at Sree Balaji Medical College , Chromepet , Chennai, Tamilnadu over a period of 6 months from September 2015 to February 2016 .The parameters assessed were age, gender ,fractured site and associated soft tissue injuries. Of the 250 patients studied, 56 % of the facial bone fractures involved people between 21- 40 years while 10.4 % of the fractures involved more than 60 years of age. Incidence of maxillary fractures was 32%, orbital wall was 24% and temporal bone was 4.1 %. 77.6 % of those affected were males while the remaining 22.4 % were females. In our setup, maxillary bone fractures were found to be the most common facial bone fracture and males were found to constitute a significant number of the affected population than females, while young adults in the age group of 21-40 years were the most commonly involved group.
**Keywords:** Facial bone, fractures, CT, Maxilla, nasal bone, zygomatic.

## INTRODUCTION

Facial bone fractures and associated soft tissue injury is common in trauma patients and a quick and accurate diagnosis is essential for timely intervention [1]. The demographic factors associated with facial trauma have been mentioned in a few previous studies [2-4]. Based on the population studied the epidemiology of the fractures seen will vary, the factors considered being type, severity and cause of injury [5] .According to Haug et al [6] assaults and motor vehicle accidents are usually the most common causes of facial fractures, and lacerations followed by neurologic and orthopedic injury were the most frequently encountered concomitant injuries. Plain radiography and CT imaging are primarily used for assessment of facial injuries. A recent study by Peterson BE et al had shown that diagnosis of nasal bone fracture by conventional radiography shows similar sensitivity and specificity as a CT diagnosis [7] .Ultrasound also shows similar sensitivity and specificity as CT, for nasal bone fractures as per another study [8] .Hence the need for radiation exposure and increased expenditure can be avoided, However CT is definitely superior for assessment of the complex facial bone fractures.

## MATERIALS AND METHODS

The study was performed based on the CT findings of facial bone injury in 250 patients at Sree Balaji Medical College , Chromepet , Chennai, Tamilnadu over a period of 6 months from September 2015 to February 2016 . All the patients referred for CT of the facial bones following trauma, were included in the study. CT of the facial bones done for non trauma cases, were excluded from the study. The CT protocol used for assessing facial bones is as follows: Tube voltage -120 KV; Tube current – 50mA; Scanogram length – 250 mm; Scano mode – Lateral; Collimation – 0.63 x 8. Images were acquired in axial plane and reconstructed as 1 mm sections in both bone as well as soft tissue windows. The parameters assessed were age, gender, fracture site and associated soft tissue injuries. The sites primarily assessed were nasal bone and nasal septum, orbital wall, orbital floor, zygoma, maxilla, hard palate, pterygoid plates, mandible and temporal bone. Frontal bone, frontal sinus and sphenoid sinus fractures were classified as other fractures.

## RESULTS
### DEMOGRAPHICS

Incidence of facial bone fractures were found to be highest in people between the age group of 21 - 40 years (56%) ,while the incidence was least in elderly people above 60 years of age (10.4%). Patients in the age group of 41-60 years comprised 21.2% while those below 20 years formed 12.4 % of the 250 patients studied ( Figure 1).

Males were found to be more prone to facial bone fractures than females with an incidence of 77.6 %( 194/250) while females comprised 22.4 %( 56/250).

Females were more than males among the affected population up to 40 years of age and after 40 years of age number of males were higher .Below 20 years females comprised 14.3 % and males 11.9 %. Between 21 – 40 years of age females formed 60.7 % and males 54.8 %. At 41-60 years females made up 19.6 % and males 21.2% . Above 60 years females comprised 5.4, while males formed 11.9 % (Figure 2)

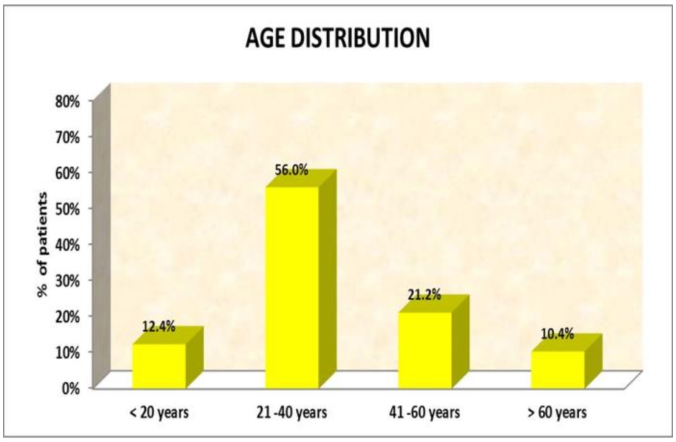


**Fig-1: Age distribution**

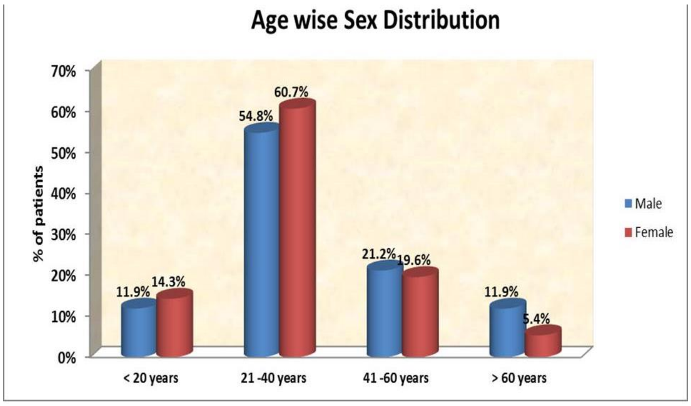


**Fig-2: Sex distribution**

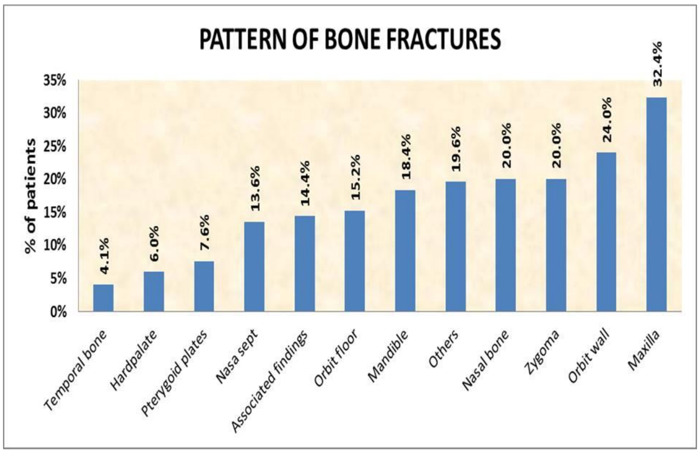


**Fig-3: Pattern of Bone Fractures**

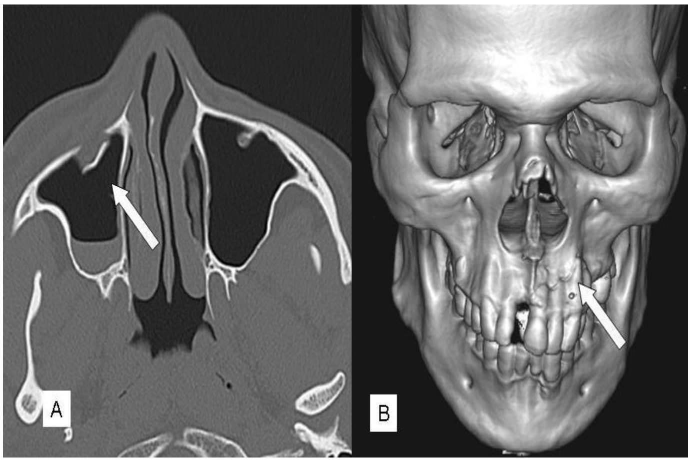


**Fig-4: A: White arrow shows fractured anterior wall of right maxillary sinus, B: Volume rendered image shows fracture of the anterior wall of left maxillary sinus**

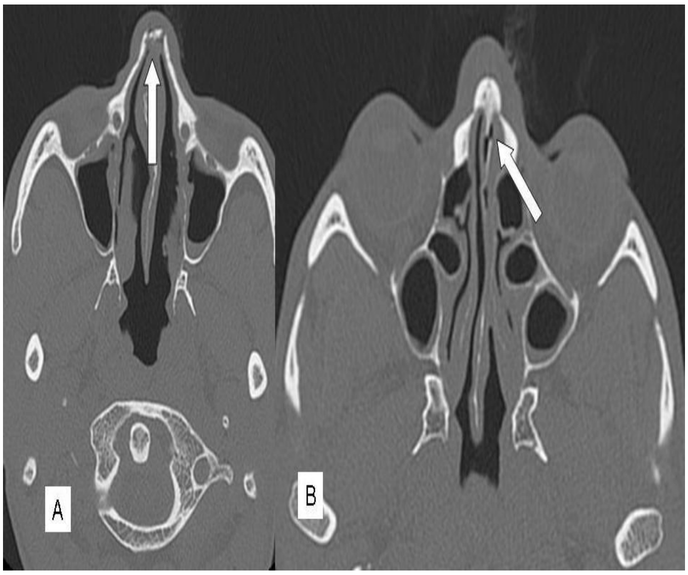


**Fig-5: A: White arrow shows nasal bone fracture, B: White arrow shows nasal septal fracture**

**DISTRIBUTION BASED ON FRACTURED SITE**

Most of the fractures involved the maxilla (32.4%) (Figure 4), followed by orbital wall (24%) and nasal bone (Figure 5 A) and zygomatic bone fractures at 20 %. Mandibular fractures were present in 18.4%, orbital floor fractures in 15.2%, nasal septum fractures (Figure 5 B) in 13.6%, pterygoid plate fractures in 7.6% and hard palate fractures in 6 %. Temporal bone fractures were found in least number of patients with incidence at 4.1 %. Other craniofacial bone fractures were seen in 19.6 %. (Figure 3)

In patients less than 20 years there is a high incidence of nasal septal fractures, with 26.5% (9/34) of the nasal septal fractures occurring in this age group. At 21-40 years orbital wall fractures were of the highest incidence with 55% of the patients being affected (33/60).

At 41-60 years there is a high incidence of temporal bone (4/10) and hard palate fractures (6/15) with 40 % of the patients being affected for each fracture. Above 60 years, temporal bone (1/10) and orbital wall fractures (6/60) were most common with 10 % of the patients being affected for each fracture. In males, orbital wall fractures are most common, occurring in 89.8 % of the patients (53/60). In females mandibular fractures were most common occurring in 32.6% of the patients (15/46) (Table 1, 2).

**Table 1: Age-wise distribution of the facial bone fractures on CT**

| | | Age | | | | | | | | Total | Chi square test |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | < 20 years | | 21 -40 years | | 41 -60 years | | > 60 years | | | |
| | | n | % | n | % | n | % | n | % | | |
| Nasal bone | No | 22 | 11.0% | 114 | 57.0% | 40 | 20.0% | 24 | 12.0% | 200 | 2=4.90 p=0.18 |
| | Yes | 9 | 18.0% | 26 | 52.0% | 13 | 26.0% | 2 | 4.0% | 50 | |
| Nasal septum | No | 22 | 10.2% | 124 | 57.4% | 45 | 20.8% | 25 | 11.6% | 216 | 2=9.05 p=0.03* |
| | Yes | 9 | 26.5% | 16 | 47.1% | 8 | 23.5% | 1 | 2.9% | 34 | |
| Orbit wall | No | 23 | 12.1% | 107 | 56.3% | 40 | 21.1% | 20 | 10.5% | 190 | 2=0.09 p=0.99 |
| | Yes | 8 | 13.3% | 33 | 55.0% | 13 | 21.7% | 6 | 10.0% | 60 | |
| Orbit floor | No | 28 | 13.2% | 121 | 57.1% | 40 | 18.9% | 23 | 10.8% | 212 | 2=4.87 p=0.18 |
| | Yes | 3 | 7.9% | 19 | 50.0% | 13 | 34.2% | 3 | 7.9% | 38 | |
| Zygoma | No | 27 | 13.5% | 116 | 58.0% | 36 | 18.0% | 21 | 10.5% | 200 | 2=6.53 p=0.08 |
| | Yes | 4 | 8.0% | 24 | 48.0% | 17 | 34.0% | 5 | 10.0% | 50 | |
| Maxilla | No | 22 | 13.0% | 101 | 59.8% | 30 | 17.8% | 16 | 9.5% | 169 | 2=4.84p=0.18 |
| | Yes | 9 | 11.1% | 39 | 48.1% | 23 | 28.4% | 10 | 12.3% | 81 | |
| Hard palate | No | 28 | 11.9% | 135 | 57.4% | 47 | 20.0% | 25 | 10.6% | 235 | 2=5.08 p=0.16 |
| | Yes | 3 | 20.0% | 5 | 33.3% | 6 | 40.0% | 1 | 6.7% | 15 | |
| Pterygoid plates | No | 27 | 11.7% | 131 | 56.7% | 48 | 20.8% | 25 | 10.8% | 231 | 2=2.29p=0.51 |
| | Yes | 4 | 21.1% | 9 | 47.4% | 5 | 26.3% | 1 | 5.3% | 19 | |
| Mandible | No | 28 | 13.7% | 116 | 56.9% | 37 | 18.1% | 23 | 11.3% | 204 | 2=7.53 p=0.05* |
| | Yes | 3 | 6.5% | 24 | 52.2% | 16 | 34.8% | 3 | 6.5% | 46 | |
| Temporal bone | No | 30 | 12.7% | 132 | 55.9% | 49 | 20.8% | 25 | 10.6% | 236 | 2=2.14 p=0.56 |
| | Yes | 1 | 10.0% | 4 | 40.0% | 4 | 40.0% | 1 | 10.0% | 10 | |
| Associated findings | No | 28 | 13.1% | 121 | 56.5% | 43 | 20.1% | 22 | 10.3% | 214 | 2=1.51 p=0.67 |
| | Yes | 3 | 8.3% | 19 | 52.8% | 10 | 27.8% | 4 | 11.1% | 36 | |
| Others | No | 14 | 7.0% | 117 | 58.2% | 46 | 22.9% | 24 | 11.9% | 201 | 2=29.06 p=0.001*** |
| | Yes | 17 | 34.7% | 23 | 46.9% | 7 | 14.3% | 2 | 4.1% | 49 | |

**Table 2: Gender distribution of the facial bone fractures on CT**

| | | sex | | | | | Chi square test |
|---|---|---|---|---|---|---|---|
| | | Male | | Female | | Total | |
| | | n | % | n | % | | |
| Nasal bone | No | 156 | 78.4% | 43 | 21.6% | 200 | 2=0.44 p=0.51 |
| | Yes | 37 | 74.0% | 13 | 26.0% | 50 | |
| Nasasept | No | 168 | 78.1% | 47 | 21.9% | 216 | 2=0.35 p=0.55 |
| | Yes | 25 | 73.5% | 9 | 26.5% | 34 | |
| Orbit wall | No | 140 | 73.7% | 50 | 26.3% | 190 | 2=6.73 p=0.01** |
| | Yes | 53 | 89.8% | 6 | 10.2% | 60 | |
| Orbit floor | No | 161 | 75.9% | 51 | 24.1% | 212 | 2=2.00 p=0.16 |
| | Yes | 32 | 86.5% | 5 | 13.5% | 38 | |
| Zygoma | No | 155 | 77.5% | 45 | 22.5% | 200 | 2=0.00 p=0.99 |
| | Yes | 38 | 77.6% | 11 | 22.4% | 50 | |
| Maxilla | No | 127 | 75.1% | 42 | 24.9% | 169 | 2=1.68 p=0.19 |
| | Yes | 66 | 82.5% | 14 | 17.5% | 81 | |
| Hard palate | No | 182 | 77.4% | 53 | 22.6% | 235 | 2=0.01 p=0.92 |
| | Yes | 11 | 78.6% | 3 | 21.4% | 15 | |
| Pterygoid plates | No | 179 | 77.8% | 51 | 22.2% | 231 | 2=0.17 p=0.67 |
| | Yes | 14 | 73.7% | 5 | 26.3% | 19 | |
| Mandible | No | 162 | 79.8% | 41 | 20.2% | 204 | 2=3.91 p=0.05* |
| | Yes | 31 | 67.4% | 15 | 32.6% | 46 | |
| Temporal bone | No | 182 | 77.4% | 53 | 22.6% | 236 | 2=0.30 p=0.58 |
| | Yes | 7 | 70.0% | 3 | 30.0% | 10 | |
| Associated findings | No | 164 | 76.6% | 50 | 23.4% | 214 | 2=0.66 p=0.41 |
| | Yes | 29 | 82.9% | 6 | 17.1% | 36 | |
| Others | No | 155 | 77.5% | 45 | 22.5% | 201 | 2=0.00p=0.99 |
| | Yes | 38 | 77.6% | 11 | 22.4% | 49 | |

## DISCUSSION

Facial injuries are classified in three major groups: A. local injuries to the face including blowout fractures of the orbital floor, orbital rim fractures, nasal arch fractures and zygomatic arch fractures; B, the tripod fracture and its variants; and C, the complex fractures including LeFort I, II and III fractures, LeFort variations such as LeFort-tripod fracture combinations, and the most severe of facial fractures, the "smash" type of injury [9].

Previous studies have shown nasal bone fractures followed by mandibular fractures to be the most common bones involved [10]. Similarly studies perfomed by Brian Kelley et al showed nasal bone fractures accounting for more than 50 percent of the facial bone fractures [11]. However in our study maxilla was most commonly involved (32.4%), followed by the orbital wall (24%) and zygoma (20%).The least involved bone was the temporal bone (4.1%).

Fracture of the zygomatico maxillary complex is caused by a direct traumatic blow to the malar eminence, which results in separation of the zygomatic bone from the calvaria. The zygomatic bone constitutes part of the lateral orbital walls inferior to the frontal bone, the anterior and lateral maxillary sinus walls superior to the hard palate, and the zygomatic arch anterior to the temporal bone and is normally connected to the rest of the facial skeleton and the calvaria by four sutures. A zygomaticomaxillary complex fracture extends through these four sutures. This fracture pattern was previously known as a tripod fracture because only three disrupted sutures (the zygomatico frontal, zygomatico maxillary, and zygomatico temporal sutures) could be discerned at screen-film radiography [12].

Some studies have shown that males are more commonly affected than females, and this is consistent with our study where males were commonly affected at 77.6 % [13, 14] .Fractures were more common in age group of 16 – 30 years in the study perfomed by Richard Haug *et al.;* [6] and similar findings in study perfomed by J Kiesera *et al.;* where average age was 21. Average age was found to be 37 in another study perfomed by Veerasathpurush *et al.;* [15]. This is again consistent with the findings in our study where most of the affected population was between 21 and 40 years of age.

Orbital fractures can be classified by the bones involved, or by the direction of the fracture: blow-in vs. blow-out vs. blow-up. Blow-in fractures refers to the superior displacement of the orbital floor. Blow-up fracture refers to the superior displacement of the roof into the cranial fossa without involvement of the orbital rim and in blow-out fractures there is a tendency for soft tissue to herniate out of the orbit [16].

Iida *et al.;* reported that the most common mandibular fracture site was the condyle (33.6%), followed by the angle (21.7%). Ahmed *et al.;* indicated that regarding the distribution of mandibular fractures, the majority (25.0%) occurred in the condyle and 23.0% in the angle.

## CONCLUSION

In our setup, maxillary bone fractures were found to be the most common facial bone fracture and males were found to constitute a significant number of the affected population than females, while young adults in the age group of 21-40 years were predominantly involved with maxillary bone fractures primarily seen in this age group .

## REFERENCES

1. Erol B, Tanrikulu R, Görgün B; Maxillofacial fractures: Analysis of demographic distribution and treatment in 2901 patients (25-year experience) J Cranio maxillofac Surg. 2004; 32:308–13.
2. Bataineh AB; Etiology and incidence of maxillofacial fractures in the north of Jordan. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998; 86:31–5.
3. Iida S, Matsuya T; Paediatric maxillofacial fractures: Their aetiological characters and fracture patterns. J Cranio maxillofac Surg. 2002; 30:237–41.
4. Van Hoof RF, Merkx CA, Stekelenburg EC; The different patterns of fractures of the facial skeleton in four European countries. Int J Oral Surg. 1977; 6:3–11.
5. Hogg NJ, Stewart TC, Armstrong JE, Girotti MJ; Epidemiology of maxillofacial injuries at trauma hospitals in Ontario, Canada, between 1992 and 1997. J Trauma. 2000; 49:425–32.
6. Haug R.H, Prather J, Indresano A.T; An epidemiologic survey of facial fractures and concomitant injuries. Journal of Oral and Maxillofacial Surgery, 1990; 48(9): 926-932.
7. Peterson, Doerr; Utility of computed tomography scans in predicting need for surgery in nasal injuries; Cranio maxillofac Trauma Reconstr. 2013; 6(4):221-4.
8. Javadrashid R, Khatoonabad M, Shams N, Esmaeili F, Jabbari Khamnei H; Comparison of ultrasonography with computed tomography in the diagnosis of nasal bone fractures Dento maxillofac Radiol. 2011; 40(8): 486–491.
9. Kenneth D. Dolan, Charles G. Jacoby, Wendy R. K. Smoker; The radiology of facial fractures 1984; 4(4): 577-663.
10. Lim KW, Kim JC, Kim SH, Kim SH; A clinical and statistical analysis of the facial bone fractures: From 1994 to 1998. J Korean Soc Plast Reconstr Surg 1999; 109:1151-9.
11. Brian P. Kelley, B.S, Cara R. Downey, Samuel Stal; Evaluation and Reduction of Nasal Trauma

Evaluation and Reduction of Nasal Trauma Semin Plast Surg. 2010; 24(4): 339–347.
12. Fred J. Laine; Radiology of maxillofacial trauma 1993; 22(4):148-188.
13. Kiesera J; Serious facial fractures in New Zealand from 1979 to 1998 International Journal of Oral and Maxillofacial Surgery 2002; 31(2): 206–209.
14. Hamad Ebrahim Al Ahmed, Mohamed A. Jaber; The pattern of maxillofacial fractures in Sharjah, United Arab Emirates. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2004; 98(2):166–170.
15. Veerasathpurush Allareddy, Veerajalandhar Allareddy, Romesh P. Nalliah; Epidemiology of Facial Fracture Injuries Journal of Oral and Maxillofacial Surgery 2011; 69(10): 2613–2618.
16. Ken Y. Lin, Philip Ngai, Julio C. Echegoyen, Jeremiah P. Tao; FACS Oculoplastic Imaging Update, Imaging in orbital trauma, Saudi Journal of Ophthalmology 2012; 26: 427–432.
17. Iida S, Kogo M, Sugiura T, Mima T, Matsuya T; Retrospective analysis of 1502 patients with facial fractures. Int J Oral Maxillofac Surg 2001; 30: 286–290.
18. Al Ahmed HE, Jaber MA, Fanas SHA, Karas M; The pattern of maxillofacial fractures in Sharjah, United Arab Emirates: a review of 230 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004; 98: 166–170.