

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)

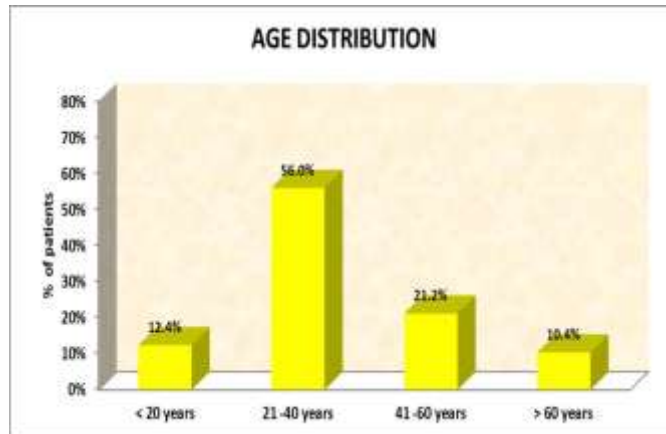


Fig-1: Age distribution

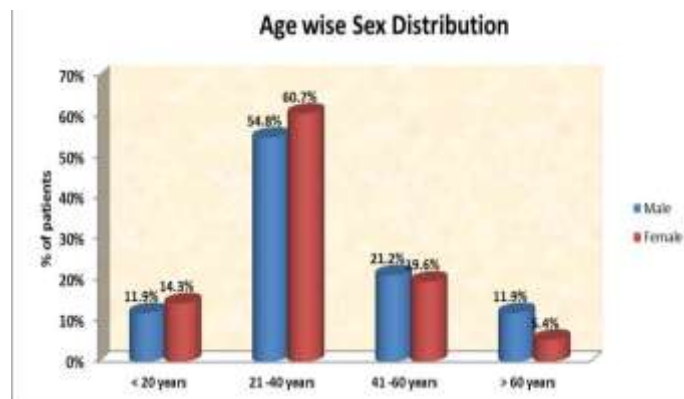


Fig-2: Sex distribution

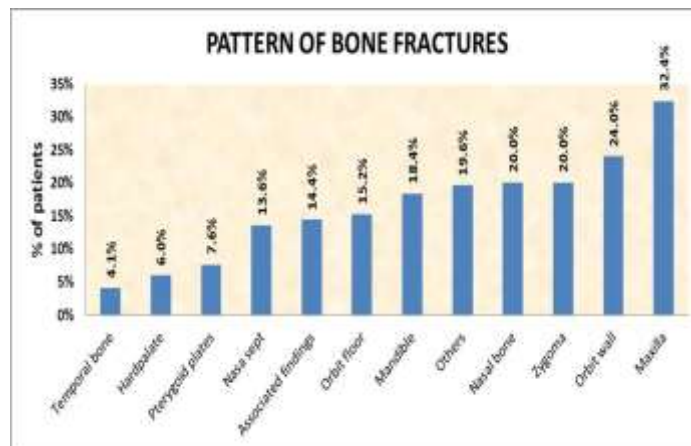


Fig-3: Pattern of Bone Fractures

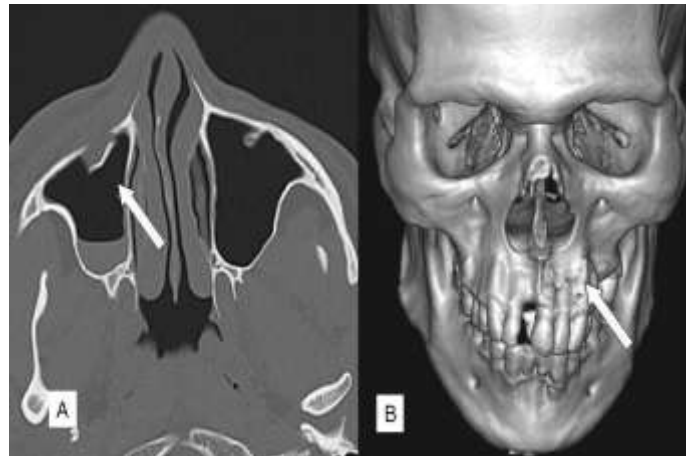


Fig-4: A: White arrow shows fractured anterior wall of right maxillary sinus, B: Volume rendered image shows fracture of the anterior wall of left maxillary sinus

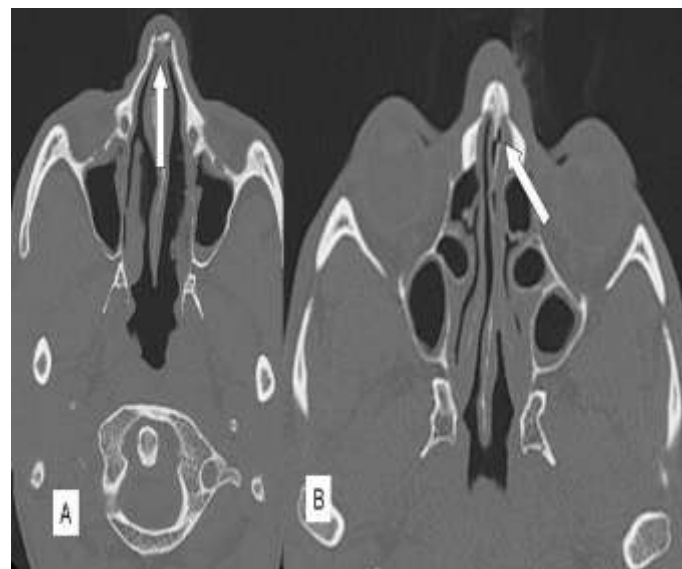


Fig-5: A: White arrow shows nasal bone fracture, B: White arrow shows nasal septal fracture

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				Total	Chi square test
		Male		Female			
		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 performed 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 zygomatico maxillary 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 performed by Richard Haug *et al.*; [6] and similar findings in study performed by J Kiesera *et al.*; where average age was 21. Average age was found to be 37 in another study performed 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 .

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