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Prevalence and etiology for mandibular and mid-face bone fractures in a tertiary care hospital

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ABSTRACT

Background: The rate of mandibular and mid-face bone fracture was found to vary among the population. This study sought to find out the prevalence of mandibular and mid-face bone fractures in a tertiary care hospital.

Methods: A retrospective study was conducted over the period of three years. Subjects aged 5-80 years with mandibular and mid-face bone fractures admitted for surgical intervention were included. Type, pattern and major etiological factors for bone fracture were accounted for and subjected to statistical analysis.

Results: Among the 103 cases, mandibular fracture was observed in 72 cases (45 single and 27 combined bones) with male dominance (69 males and 3 females; 23:1 ratio). The mid-face bone fractures were found in 41 cases within the male group (32 single and 9 combined bones). For the mandibular and mid-face bone fractures, the most prevalent age groups were the 19-29 and 30-49 years, respectively ($p = 0.80$). The parasymphysis/body (33%) and condyle/ramus (20%) were the bone fracture among the mandible observed with the highest frequency, while that of the mid-face bone was for the maxilla (43.7%) and zygoma (31.2%). Road traffic accidents (RTAs) were the major cause of these sorts of fractures in the 19-29 age group (62%; $p = 0.001$).

Conclusion: The mandible was the single most common site of bone fracture because of RTAs in males 19-29 years of age. This emphasizes the need for public health awareness so that people follow general traffic rules and road safety measures. Prevalence was found to vary based on socioeconomic, cultural, and behavioral variations among the populations.

Key words: *Mandible, maxillofacial bone, parasymphysis, ramus, condyle, orbit, ethmoid, sphenoid*

Introduction

Injury to the maxillofacial bone was found to be alarmingly elevated over the last decades. A number of the previous studies have reported that those in middle age were more prone to the incidence of maxillofacial trauma with mandibular bone fracture being dominant [1-3]. Road traffic accidents (RTAs) were found to be the major etiological factor for maxillofacial bone fractures in developing countries [4,5]. As a result of the functional as well as cosmetic impact, injuries to the maxillofacial bones are considered psychologically disturbing. The time taken to heal from the injury to the bone and soft tissue varies according to age, severity as well as the site of injury. Furthermore, presence of teeth

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and exposure to the external environment makes mandible fractures more complex.

Generally, the rate of maxillofacial bone injury has been determined to vary among populations studied. This can be explained based on changes in socioeconomic, cultural, and behavioral variations among populations [6]. The etiological factors for fracture have also been seen to vary by age [7]. This emphasizes the need for a regional study to identify the type and causes of fractures that may direct appropriate remedial programs within society [8,9]. As stated earlier, maxillofacial bone fractures are more widely reported in middle-aged populations [10,11]. However, a more recent study in this region has yielded fragmentary results. Hence, this retrospective study aimed to establish the most prevalent maxillofacial bone injury and the probable causes.

Material and Methods

A retrospective study was conducted at the Department of Maxillofacial Surgery of a tertiary care hospital over the course of three years (March 2011 to March 2014). All cases of mandibular and mid-face bone fracture patients that were admitted for surgical intervention were included. The details of the type and pattern of fracture, such as single bone fracture and combined fractures - fracture of two bones - were distributed into ages ranging from 5-80 years. Details of the mandibular bone, such as symphysis, parasymphysis, body, angle and ramus and condyle, were assessed. Similarly, the bones, like the maxilla, nasal bone, ethmoid, sphenoid and zygomatic were included in the mid-face bone. Cases below five and above 80 years of age were excluded. The details of major etiological factors for bone fractures were also accounted for. The study was conducted according to the regulations for conducting studies in human participants and approved by the Institutional Ethics Committee.

Statistical Analysis

Analysis was performed using the statistical software package, GraphPad (GraphPad InStat, San Diego, CA, USA). Chi-square and Fisher's exact tests were carried out to determine any statistically significant differences existing between the type of bone fracture or the etiological factors of the bone fracture, respectively. p-values less than 0.05 were considered significant.

Results

A total of 103 subjects were recruited during the course of the study. Among all cases, 100 were male and three were female (Figure 1). Mandible fracture was observed in 72 cases (69.9%) in a ratio of 69 males to three females (male to female ratio - 23:1) (Figure 2) and fracture of the mid-face was found in 41 cases (39.8%; all males). Among the total cases, both mandibular plus mid-face bone fractures were found in 9.7 % cases (10/103). Female subjects with neither mid-face nor mandibular plus mid-face bone fractures were seen in this study. Subjects with mandibular bone fracture comprised 5/72 (male to female ratio - 4:1) in the above 65 years age group, whereas those with mid-face

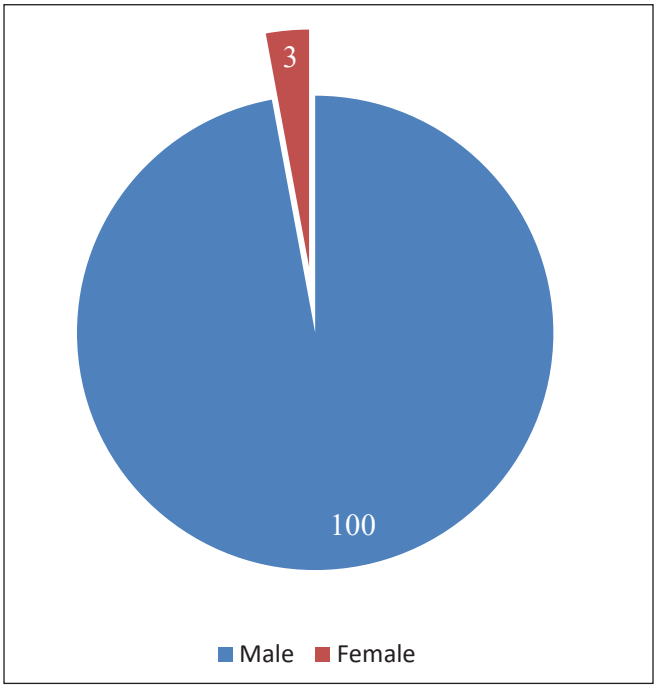

Figure 1. Distribution of gender.

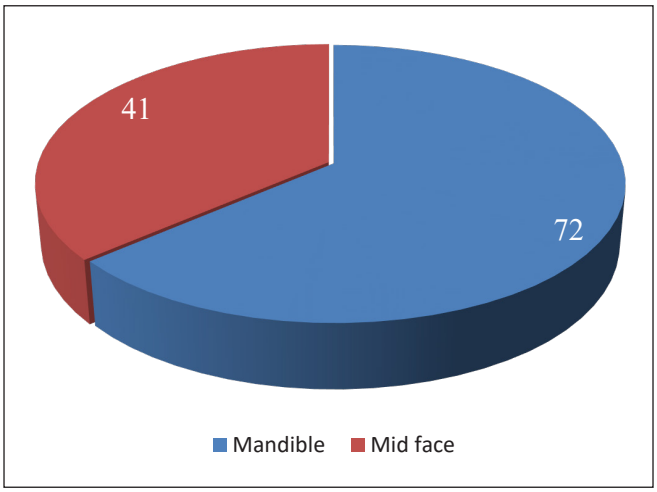

Figure 2. Distribution of type of mandibular and mid-face bone fracture.

Table 1. Distribution of age with pattern of mandibular bone fracture.

Age	Gender Male (M) / Female (F)	Pattern of single bone fracture				
		Angle	Symphysis	Para-symphysis / Body	Dento-Alveolar	Ramus/Condyle
< 18	M (N =3)	1	-	1	-	1
	F (N = 0)	-	-	-	-	-
19-29	M (N = 18)	2	4	7	4	1
	F (N = 0)	-	-	-	-	-
30-49	M (N = 16)	3	2	4	2	5
	F (N = 0)	-	-	-	-	-
50-64	M (N = 5)	1	1	2	-	1
	F (N = 0)	-	-	-	-	-
> 65	M (N = 3)	-	1	1	-	1
	F (N = 0)	-		-	-	-
Total	M (N = 45)	7	8	15	6	9
	F (N = 0)	0		0	0	0

bone fractures was equivalent to only one (a male). None of the subjects in this age group had both mandibular plus mid-face bone fractures. Similar observations were evident in the less than 18 years age group, where five subjects had mandibular fractures and only one had a mid-face bone fracture. No statistically significant difference could be determined among the mandibular and mid-face bone fractures among the 19-20 and 30-49 years of age groups (p = 0.80).

Among the cases with mandibular fracture, no female subjects were observed in the 19-29 or 30-49 years age groups. The < 18, 50-64 and >65 years age groups each had just one female subject (Table 1). While 45 subjects (all males) had fractures of the mandibular bone, 27 subjects (24 males and 3 females) had combined bone fractures. The most commonly seen age group for mandibular bone fracture was the 19-29 years of age group. Among them, the fracture of the parasymphysis bone alone was found in 7/31, while there were four cases of each parasymphysis plus ramus or symphysis plus ramus fractures (Table 1). The second most prevalent age group was those 30-49 years of age (23/72) with respect to fractures of the ramus/condyle (5/23). Combined cases of parasymphysis plus ramus/condyle fracture in this age group was equivalent to 7/23 (Figure 3).

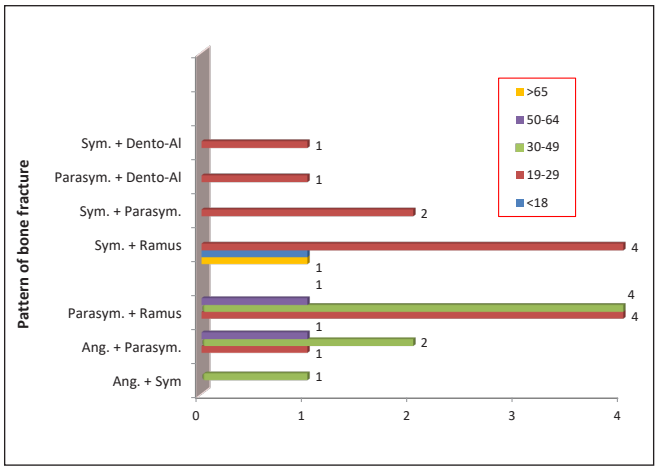

Figure 3. Distribution of combined mandibular bone fracture. Ang: Angle; Sym: Symphysis; Parasym: Parasymphysis; Dento-Al: Dento-Alveolar.

Among the 41 males with mid-face bone fractures, 32 had single bone fractures and 9 possessed combined bone fractures. No statistically significant difference was found among the number of mandibular and mid-face bone fractures (p = 0.137). Within the 32 single bone fracture cases, the site of fracture was most frequently the maxilla (43%) and for the 9 combined fracture cases, zygomatic plus maxilla was the greatest proportion (Figure 4). The most prevalent age group for mid-face bone fracture was 30-49 years (51%) followed by the 19-29 age group (39%) (Table 2). Among the fractures of both the mandibular plus the mid-face bone, the 19-29 age group was predominant. The major etiological factors for the fractures are listed in Figure 5. RTAs were found to be the major cause, statistically significant (p = 0.001; relative risk of 2.286 at a 95% confidence interval (CI) of 1.258-4.152) in the 19-29 age group (64/103).

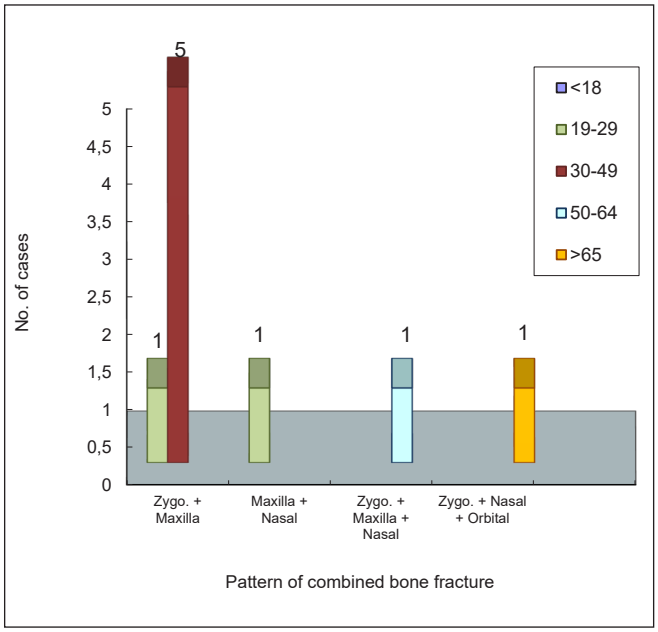

Figure 4. Distribution of combined mid-face bone fractures. Zygo: Zygomatic.

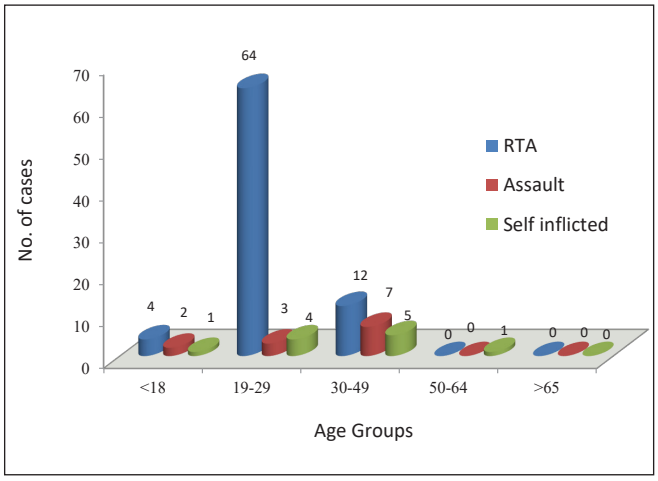

Figure 5. Distribution of causes of fractures with age.

Discussion

The results of this study revealed that mandibular fractures remain the most frequent major bone fracture. The gender-wise analysis established that males were involved in the vast majority of cases with incidence most apparent in the age group of 19-29 years. A similar observation was reported by Ravindran and Nair, conducted previously in northern districts of Kerala state [11]. Specifically, they observed that the highest numbers of patients were in the 20–30 years age group followed by 30-40 years age group. The observation of male prevalence was also supported by other earlier studies [10,12-15]. The greater incidence in males can be ascribed to the use of motor vehicles and the associated RTAs.

The most regular site of fracture was the mandible, probably because of the long bone with inner cancellous and outer cortical plate. Among the facial fractures reported, mandibular fractures varied from 24% to 73% [3,16-18]. Here, we found a mandibular fracture rate of 69%. Among bone fractures of mandible, the parasymphysis/body (33%) and ramus/condyle (20%) were most highest prevalent. According to De Matos et al. the location of highest frequency for mandible fractures was the condyle followed by the mandibular body, mainly based on RTAs and falls [12]. Similarly, Zix et al. described a large proportion condylar fractures followed by the mandibular symphysis and angle primarily from RTAs and sports injuries [19]. As well,

Table 2. Distribution of age with pattern of mid-face bone fracture.

Age	Gender Male (M) / Female (F)	Pattern of single bone fracture			
		Zygoma	Maxilla	Nasal	Ethmoid / Sphenoid
< 18	Male (N =1)	1			
	Female (N = 0)				
19-29	Male (N = 14)	5	5	2	2
	Female (N = 0)				
30-49	Male (N= 16)	5	8	2	1
	Female (N = 0)	-	-	-	-
50-64	Male (N = 1)	-	-	1	-
	Female (N = 0)	-	-	-	-
> 65	Male (N = 0)	-	-	-	-
	Female (N = 0)	-	-	-	-
Total	Male (N = 32)	11	13	5	3
	Female (N =0)	0	0	0	0

Subhashraj et al., in this very region, also provided evidence for the parasymhysis fracture (31%) being the most common mandibular fracture [10]. The exact reason for this variation is not clear from this single centre-based study, however the changes in socioeconomic, cultural and behavioral variations among populations may be responsible for this observation.

We found the fracture of mid-face bone to be 31.8% involving the maxilla as the dominant single bone fracture (43%), and among combined fractures, the zygomatic plus maxillary were predominant. The most common type of mid-face fracture previously reported affected the zygomatic complex (zygomatic and its surrounding bones) [11]. As a consequence of the prominence and central location of the nose, nasal bone fractures have been described in up to 50% of all facial bone fractures [20,21]. Yet, during the course of this study, just a few cases of nasal fractures were observed.

The major etiology was established as RTAs. The results of previous studies are also consistent with this report, where the major etiological factors reported were traumatic injuries, including RTAs, falls from heights and assaults [8,9,15]. Among the different types of vehicles involved in RTAs, motorcycles were the most prominent [10,11,22,23]. The conservative or operative treatment remains major therapeutic intervention for facial bone fractures. The management of mandibular bone fractures mainly consists of placing the fractured bone into place by either an open- or a closed-reduction technique. Indirect skeletal fixation or maxillo-mandibular fixation using a resin-bonded arch bar with wire loops are recommended in order to secure the maxillary and mandibular dentition. Despite the method used for fixation, the bone must remain relatively stable for a period of 3–6 weeks. The bone gains an average of 80% of its strength by three weeks and 90% by four weeks depending on the age of the patient.

Though the conservative or operative treatment continues to be major therapeutic intervention, prevention was found to be the most economic way to diminish the trauma rates and associated treatment costs. Therefore, effective prevention requires the identification of risk factors related to traumatic injuries. Based on the fact that the chief etiological factor found in this study was RTAs, preventive measures, like limiting the speed of vehicles, compulsion to follow laws, use of seat belts and enforcing helmet usage may be effective in decreasing incidence. The small number of patients because a single-centre study is the major limitation of this work.

Conclusion

The mandibular bone remains the major site for fractures from RTAs. The 19-29 years of age group with male predominance emphasizes the need for a public health awareness program advocating following general traffic rules and road safety guidelines.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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