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Incidence and patterns of fractures of Mandible, Midface or both using CT scan in trauma patients

Altaf Hussain Chalkoo[1], Nusrat Nazir[2,*], Gowhar Yaqub[3], Zahoor Bhat[4], Saima Tariq[5]

[1]Professor & HOD, [2,3,4,5]PG Student, Dept. of Oral Medicine & Radiology, Govt. Dental College, Srinagar, Jammu & Kashmir

***Corresponding Author:**
Email: drnusratnaziromar@gmail.com

Abstract

Background: The aim of present study was to assess the incidence of fractures of maxillofacial region in Kashmir population and to compare the results with worldwide incidence of maxillofacial trauma cases.

Materials and Methods: This was an observational, prospective, longitudinal study of patients presenting successively with maxillofacial fractures, attending the Department of Oral and Maxillofacial Radiology Government dental college Srinagar, Kashmir over 2 years and 5months. During study a total of 570 patients were attended by our department with maxillofacial injuries and 457 were included in the study. Imaging was performed using a 64-slice CT scanner, 16-slice CT scanner or using a 4-slice CT scanner. Imaging protocols included axial images reformatted in the coronal and optionally sagittal planes. Incidence of fractures in mandible, mid-face and both were calculated and cause of trauma was also documented.

Results: Majority of patients had isolated mandibular fractures followed by mid-face and combined mandible and mid-face irrespective of gender. Traffic accidents were most common cause of trauma 49.8%, followed by assaults, falls and stumbling 18.3%. Most common mandibular fracture was condylar fracture (39%) and most common mid-face fracture was zygomaticomaxillary fracture 32%.

Conclusion: The findings of this study indicated that epidemiological research of maxillofacial fractures allows the presentation patterns of the most affected individuals, common causes of trauma and sites of involvement. It can also be emphasized that CT is Gold standard for evaluating maxillofacial trauma.

Keywords: Maxillofacial trauma, CT scan, Mastoid process fracture, Assaults, Road traffic accidents

Introduction

Injuries of the maxillofacial complex represent one of the most important health problems worldwide. Particular interest is created by the high incidence and diversity of facial lesions.[1-3] According to reports of developing nations, traffic accidents are the main cause of maxillofacial fractures,[4-8] while data from developed countries pointed to assaults being considered the most frequent etiology of such fractures.[9-13] With regard to the anatomical sites, mandibular and zygomatic complex fractures account for the majority of all facial fractures and their occurrence varies according to the mechanism of injury and demographic factors, particularly, gender and age.[14-16] Severe trauma to the face is a strong indication for radiological investigation; however radiological evaluation of facial injuries may be difficult due to the complex anatomy of the region and to the difficulties in obtaining high-quality imaging studies in severely traumatized patients.[17,18] Its goal is to establish the number and exact location of the fracture.[19] There is wide agreement that the exact anatomical identification and quantification of facial fractures, the recognition of the true extent of bone displacements, and the precise assessment of major bone and soft tissue complications can be effectively and accurately imaged with high-resolution CT.[20]

Materials and Methods

This was an observational, prospective, longitudinal study of patients presenting successively with maxillofacial fractures, attending the Department of Oral and Maxillofacial Radiology Government dental college Srinagar, Kashmir over 2 years and 5months (from 1june 2014 to 30 November 2016). Most of the patients were referred from a nearby (across the road) Trauma center which were referred for dental evaluation. Study was approved by the internal Research Ethical Committee of our Institution. A total of 570 patients were attended by our department with maxillofacial injuries and 457 were included in the study. Patients who had refused to participate in the research or who had inadequately completed the form were excluded. Patients with isolated dental trauma (injuries to teeth and alveoli), either associated with soft tissue lesions or not, if CT scans were non diagnostic due to motion or technical factor and patients with underlying bone disorder or a pathologic fracture (e.g., osteogenesis imperfecta, ameloblastoma) were also excluded. Each patient underwent a clinical examination using a standardized data collection form that was specifically developed to investigate the epidemiological features of maxillofacial trauma. Patients were evaluated regarding patient age, gender, etiology, nature and type of injury. Maxillofacial fractures were distributed according to their etiological factors in traffic accidents (automobile, two wheeler and pedestrian motor vehicle accidents), assaults, falls, sports, work-related accidents, and others. Imaging was performed using a 64-slice CT scanner (120 kV; 150 mA s; collimation, 64 3 0.5; slice thickness, #2 mm; matrix, 5123 512 pixels; gantry tilt, 0°), using a 16-slice CT

scanner (120 kV; 250mAs; collimation, 163 1.0; slice thickness, #2 mm; matrix, 5123 512 pixels; gantry tilt, 0°) or using a 4-slice CT scanner (120 kV; 150 mA s; collimation, 4 3 2.0; slice thickness, #2 mm; matrix, 512 3 512 pixels; gantry tilt, 0°). Imaging protocols included axial images reformatted in the coronal and optionally sagittal planes.

Statistical analysis: Statistical software's SPSS (Version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Data were analyzed by means of descriptive statistics, *viz*., percentages and means. Graphically, the data were presented by tables. ANOVA and paired *t*-test were employed for comparison. P < 0.05 was considered statistically significant.

Results

During study a total of 570 patients were attended by our department with maxillofacial injuries and 457 were included in the study. Out of them 340 were males and 117 were females (3:1 ratio) Table 1. Age and gender distribution is depicted in Table 2. Majority of fractures were seen in the age group of 20-40 years 42% in males and 38.5% in females. Majority of patients had isolated mandibular fractures followed by midface and combined mandible and midface irrespective of gender.

Graph 1: Gender distribution of study sample

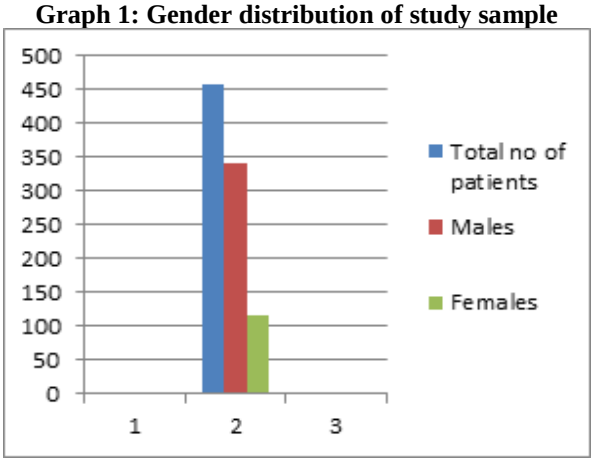

Table 1: Age and Gender distribution of patients

Age group	Males				Females			
	Mandible	Midface	mandible +midface	Total	Mandible	Midface	Mandible + Midface	total
upto 20	79	28	9	116	18	9	7	34
20-40	98	33	12	143	23	11	11	45
40-60	21	19	7	37	8	9	6	23
above 60	16	11	10	47	6	6	3	15
Total	211	91	38	340	55	35	27	117

Causes of trauma are given in Table 2. Traffic accidents were most common cause of trauma 49.8% (automobiles-22.3%, two wheelers-16.8%, Pedestrian hits-10.7%), followed by assaults, falls and stumbling 18.3%.

Table 2: Cause of Trauma

Cause of trauma	Mandible	Mid face	Mandible +midface	Total	%
Traffic accidents					
automobiles	53	24	25	102	22.30%
Two wheelers	42	21	14	77	16.80%
Pedestrian hit	19	15	15	49	10.70%
work place accidents	34	15	4	53	11.50%
Falls and stumbling	63	18	3	84	18.30%
Assaults	23	39	2	84	18.30%
sports	15	16	3	34	7.40%
others	6	2	1	9	1.90%
Total	255	135	67	457	
%	55.70%	29.50%	14.60%		

Table 3 shows that number of mandibular fractures in 255 patients were 320 among which 39% were condylar fractures (including both unilateral and bilateral cases)followed by symphysis 20.95 and angle 16.3%.

Table 3: Number fractures in 255 of isolated mandibular fractures

Number of mandibular fractures in 255 patients		
Site of fracture	**Number**	**%**
Condyle	125(R 60 L 65)	39%
Coronoid	5	1.56%
Angle	52(R 25 L 27)	16.25%
Body	31(R 16 L 15)	9.68%
Parasymphysis	20(R 12 L 8)	6.25%
Symphysis	67	20.93%
Ramus	20 (R 9 L 11)	6.25%
Total	320	

Table 4 shows number of midface fractures in135 patients were 190 among which most common were zygomatic maxillary fractures (tripod) 32% followed by isolated Zygomatic arch 19.4% and maxillary fractures (Lefort) 15.2%. Fractures involving both mandible and midface was seen in 67 patients and number of fractures in this group were 172. So total number of fractures in all patients(457) were 682 with a mean of 1.49 fracture per patient.

Table 4: Number fractures in 135 patients of isolated midface fractures

Number of midface fractures in patients in 135 patients		
Site of fracture	**Number**	**%**
Zygomaticomaxillary fractures	61 R 35 L 26	32%
Zygomatic arch	37(R28 L 9)	19.40%
Maxillary fractures (lefort)	29(R 18 L 11)	15.20%
Nasal bone	23	12.10%
Nasoorbitoethiomioda l	27(R 17 L 10)	14.20%
Orbital fractures	13 (R7 L 6)	6.80%
Total	190	

The resultant data in all tables showed a significant correlation with p value of less than 0.005.

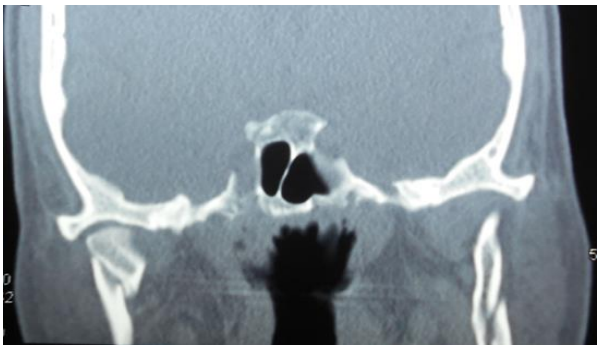

Fig. 1: Showing subcondylar fracture on one side and Fracture ramus on other side

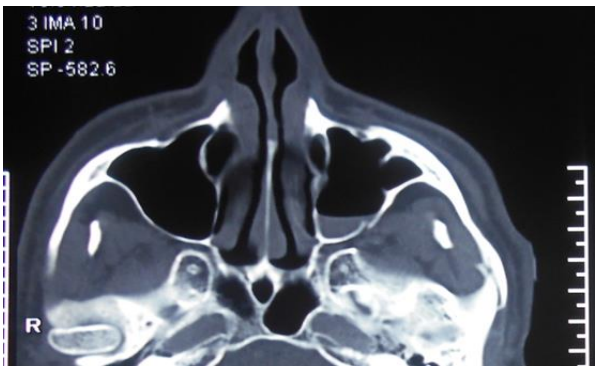

Fig. 2: Showing fracture of anterior and lateral wall of maxillary sinus with fracture of zygomatic arch(Tripod #)

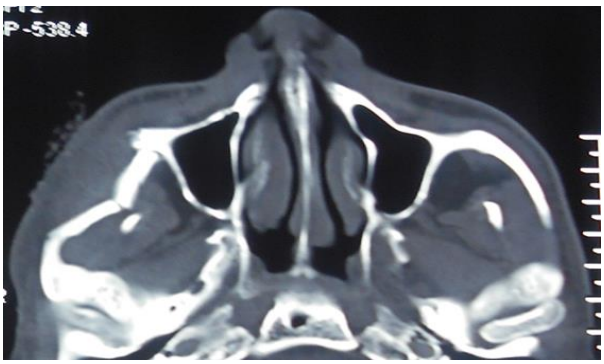

Fig. 3: Showing isolated fracture of right zygomatic arch

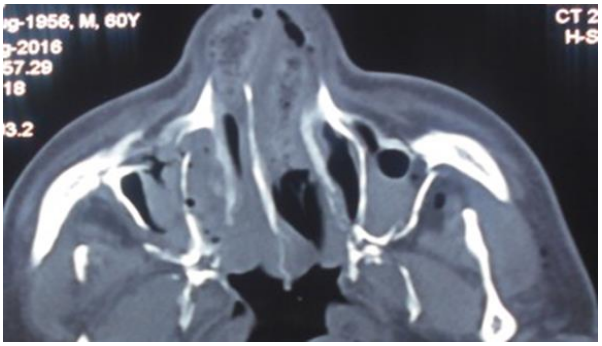

Fig. 4: Lefort II fracture (bilateral # of anterior and lateral wall of maxillary sinuses with # of lateral pterygoid plate

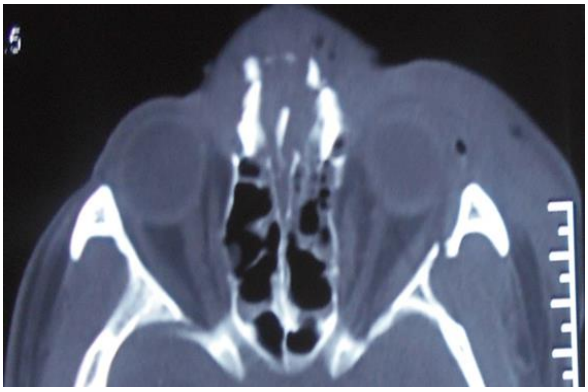

Fig. 5: Showing fracture of left lateral orbital wall

Discussion

Facial fractures can have long-term consequences both functionally and aesthetically. Many studies have shown that the causes of facial injury are influenced by many factors like socioeconomic status, geographic region, population density, era in time, and type of facility in which the study was conducted. Comparison of data requires these factors to be considered. Nonetheless, there seem to be some congruent trends. This study was conducted from 1 June 2014 to 30 November 2016 in the Department of Oral and Maxillofacial Radiology Government dental college Srinagar, Kashmir over 2 years and 5months.The study included both rural and urban citizens, with a ratio of men to women of 3:1 and regular road traffic legislation Some studies have reported that facial fractures are most commonly caused by motor vehicle related accidents,[21-24] whereas others show that assault is the most frequent cause . Recently, assault has also been found to be the most common etiology of facial trauma in many urban centers in developed countries. Hachl et al.[25] in Austria, Iida et al.[26] in Germany, and Laski et al.[27] in the United States demonstrated that developed countries have an increased incidence of interpersonal violence as the leading cause of facial injury. The results presented in our study showed the highest incidence of fractures to be caused by traffic accidents, especially by automobile related accidents. This was particularly significant in 20-40 year age group. Men aged 21 to 40 years in the active segment of the population represent a group with intense social interaction and higher rates of mobility, making them more susceptible to transport accidents and interpersonal violence, consequently leading to higher rates of maxillofacial fractures.[28-31] Although mandibular fractures have been studied extensively, studies describing the relation between cause and fracture site are rare. The largest proportion of Traffic accident related mandibular fractures in our study involved the condyle, followed by the mandibular angle. Similar fracture pattern was also seen in falls and stumbling cases. Ahmed et al[32] indicated that regarding the distribution of mandibular fractures, the majority (25.0%) occurred in the condyle and 23.0% in the angle. On the other hand, Yamamoto et al[33] showed that the condyle (38.2%) and median (27.0%) were most frequently involved in the mandible irrespective of cause of trauma. Our study also demonstrated that in cases isolated fractures of mandible the condylar type was most common (39%), followed by the median or symphysis type (20.9%). Most common fractures of mid-face region were zygomaticomaxillary fractures (tripod) 32% followed by isolated Zygomatic arch 19.4%. The results were in line with previous studies given that these parts of the face are prone to injury for anatomical reasons. A rare case of isolated fracture mastoid process was also seen in a patient due to stone hitting in that area.

The importance of CT imaging in maxillofacial trauma cannot be overemphasized. CT has become the imaging gold standard [34,35] for assessing injuries to all regions of the maxillofacial skeleton. Although CT serves as the principal means of qualifying the clinical diagnosis of complex maxillofacial fractures,[36] routine CT scanning may not be necessary in every case of facial trauma. There is, however, increasing support that CT findings are important determinants of surgical management.[37,38] Recently Dos Santos et al[39] investigated the validity of various CT protocols including axial, MPR, and 3D formats in the detection of maxillofacial fractures and found that the combination of all 3 modalities resulted in significantly higher specificity (95.8%) and sensitivity (99%) than any other combination. In trauma patients, CT shows a larger number of fracture fragments and fracture lines than conventional tomography and better depicts the position and orientation of displaced fracture fragments.[40-42]

Conclusion

Facial injuries are common and require radiologic evaluation to plan treatment. The role of imaging is to detect fractures, describe their morphology and topography, and evaluate adjacent soft tissue damage. Computed tomography is the imaging method of choice for an accurate diagnosis and for depicting the complex anatomic structures of the maxillo-facial region. The present study supports that regular epidemiologic evaluations of maxillofacial fractures allow a detailed analysis of these lesions, providing important support to install clinical and research priorities, since risk factors and patterns of presentation can be identified. Knowledge of the common patterns of injury, as well as the salient information that can guide patient management, is important for providing thorough and clinically beneficial reports.

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