Original Research

Maxillofacial Fractures in CT scan Images of Adult, Adolescent, and Child Patients in Radiology Ward of Mashhad's Shahid Kamyab Emergency Hospital in 2010

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Abstract

Introduction: This study was conducted to determine the pattern of maxillofacial fractures in three age groups of adults, adolescents, and children, using CT scan images. **Methods:** In this cross-sectional study, CT scan images of 230 patients with maxillofacial trauma during one year were examined in terms of the number and site of fractures. The patients were divided into three age groups, children (0-14 years), adolescents (14-17 years), and adults (>17 years). The data collected from this group were analyzed using, Chi-square, independent t-test and ANOVA statistical tests. **Results:** The analysis showed that 85% of maxillofacial fractures occur in adults, 7% in adolescents, and 8% in children. The most prevalent causes of fractures in adults were accidents (70%) and fallings (16%). Accidents (73%) and quarrels (13%) were the most prevalent causes of fractures in adolescents. In children, falling (60%) as the most prevalent cause of fracture was significantly higher than that in other groups (P-value=0.001). The most prevalent sites of maxillofacial fracture in adults were nasal bones and zygomaticomaxillary complex. Nasal and orbital fractures in adolescents comprised the most prevalent sites of fracture. Mandibular bone was the most prevalent site of fracture in children. The variations in prevalent sites of fracture among the three groups were significant (P-value=0.002). **Conclusion:** Car accidents are the main risk factor for maxillofacial fractures. The prevalent causes and sites of maxillofacial fractures in adults, adolescents, and children are different from one another.

Key words: Fracture, maxillofacial, trauma, adults, adolescents, children

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Introduction

The industrial development and the lifestyle changes are of main factors increasing incidents and injuries that result in fractures of maxillofacial and other parts of the body. In most parts of the world, major causes of facial fractures are car accidents, fallings, quarrels, and sports injuries (1).

Misdiagnosis and late treatment of fractures in adults may cause irreversible damages or even death. In children, these fractures can cause facial deformities, loss of teeth, and abnormalities in the growth of some bones. Therefore, knowing about causes and types of maxillofacial fractures and its age and sex distribution

can lead to early and accurate diagnosis of injuries and their better treatment.

Car accidents are the main cause of maxillofacial fractures in Iran (2-5). Considering that Mashhad receives maximum number of passengers within one year and, consequently, has a lot of road accident victims who are mainly transferred or referred to Trauma Emergency Center of Shahid Kamyab Hospital, it is necessary to conduct more studies on traumatic patients.

This study was conducted to examine maxillofacial fractures, using CT scan images, in three age groups of adults, adolescents, and children, separately, during the year 2010. In this respect, the variation in prevalence of maxillofacial fractures in different age groups would be determined, and the results could be used to increase public awareness, correct diagnosis, and timely treatment.

Materials and Methods

In this study, CT scan images of 553 maxillofacial traumatic patients going to Mashhad's Shahid Kamyab Emergency Hospital from Mar. 2010 to Feb. 2011 (one Persian year) were examined. The images were taken using Spiral CT Scan machine with 5 mm slice thickness, maximum voltage 130 kVp, and 250 mA, (Siemens, Germany). A general radiologist, an oral and maxillofacial radiologist, and an oral and maxillofacial surgeon separately examined the number and site of fractures in the CT images. Each of these specialists could change the window, level, and size of the images in axial and coronal sections for more accurate examination of the fractures. In case of a disagreement on each of the above variables, the opinion of the majority was applied. The above information along with age, sex, and cause of fracture of patients were recorded in a checklist. The patients were divided into three age groups, including children (0-14 years), adolescents (14-17 years), and adults (>17 years). The data collected from the three groups were analyzed and compared together using Chi-square, independent T-test and ANOVA statistical tests.

Results

In this cross-sectional study, CT scan images of 553 maxillofacial traumatic patients going to radiology ward of Mashhad's Shahid Kamyab Emergency Hospital were examined. Maxillofacial fractures were detected in CT scan images of 230 patients (42%).

The fractures occurred in 85% of the adults, 7% of the adolescents (14-17 years), and 8% of the children (0-14 years) suffered maxillofacial fractures. Female and male patients of the study comprised 11% and 89%, respectively. The ratio of males to females in the child, adolescent, and adult groups was 2.5, 14, and 9, respectively. Table 1 shows the sex distribution for different age groups of the patients.

The mean number of fracture sites was reported 3.59±0.207 for every patient. However, in children, adolescents, and adults, it was reported 3.4±0.613, 4.06±0.752, 3.57±0.230, respectively. There was no significant difference among the number of fractures in ANOVA result (P-value=0.859).

The most prevalent cause of fractures in adults and adolescents was car accidents, while, the second prevalent cause in adults and adolescents was fallings and quarrels, respectively. The adolescent quarrels comprised the highest percentage of prevalence among the three groups. In the children, falling was more prevalent than other causes of fracture (Table 2).

In adult and adolescent groups, fractures were most frequent in hard tissues of nasal bone. The second most prevalent sites of fracture in adults and adolescents were the zygomaticomaxillary complex (ZMC) and orbital bones, respectively. Nasal bone and orbital fractures in adolescents respectively comprised the most prevalent sites of maxillofacial fracture. No fracture was seen in zygomaticomaxillary bone of adolescents. The sphenoid bone showed the least frequent fracture in adults. In children, the most prevalent site of fracture was the mandible, then, the orbital and nasal bones. No ZMC fracture was detected in children (Table 3). The Chi square test showed a significant difference in fracture sites of the three groups (P-value=0.002).

Table 1. The sex distribution for different age groups of the patients

Age	Child		Adolescent		Adult	
Sex	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Male	14	70%	14	93%	176	90%
Female	6	30%	1	7%	19	10%
Total	20	100%	15	100%	195	100%

Table 2. The distribution for causes of fracture in different age groups of the patients

Cause of fracture	Age					
	Adults		Adolescents		Children	
Car accident	137	70%	11	73%	8	40%
Falling	32	16%	1	6.5%	12	60%
Quarrel	21	11%	2	??%	0	0
Sports	5	3%	1	6.5%	0	0
Total	195		15		20	

Table 3. The distribution of fracture sites in children, adolescents, and adults in order of the prevalence in CT scan images

Fracture site		Children		Adolescents		Adults	
		Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Hard tissues	Nosal bone	8	11.8%	10	16.4%	83	11.9%
	ZMC	0	0.0%	2	3.3%	68	9.8%
	Orbit	8	11.8%	7	11.5%	57	8.2%
	Maxillary sinus	2	2.9%	5	8.2%	54	7.7%
	mandible	13	19.1%	4	6.6%	53	7.6%
	Zygomatic bone	1	1.5%	0	0.0%	40	5.7%
	Le Fort	1	1.5%	1	1.6%	39	5.6%
	Frontal bone	6	8.8%	3	4.9%	23	3.3%
	Maxillary bone	1	1.5%	0	0.0%	22	3.2%
	Frontal Sinus	2	2.9%	4	6.6%	16	2.3%
	Suture	1	1.5%	1	1.6%	16	2.3%
	Zygomatic arch	1	1.5%	0	0.0%	16	2.3%
	Sphenoid bone	2	2.9%	3	4.9%	5	0.7%
Soft tissue involvement	Sinus	14	20.6%	8	13.1%	100	14.3%
	Preorbital	3	4.4%	1	1.6%	35	5.0%
	Nasal cavity	3	4.4%	4	6.6%	30	4.3%
	Cheek	2	2.9%	5	6.6%	30	4.3%
	Pneumocephalus	0	0.0%	3	4.9%	6	0.9%
	Total	68	100%	61	100%	697	100%

The results showed that frequent sites of fracture with various traumatic causes were different from one another, and this difference was statistically significant (P-value=0.01). Therefore, bones that mostly fractured in accidents and quarrels, fallings, and sports incidents comprised the nasal bone, mandible, and orbital bone, respectively.

The most frequent site of fracture in males was the nasal bone, then, orbital and ZMC bones, while, the most frequent site of fracture in females was the nasal bone, then, the mandible.

The results showed the presence of hematoma or soft tissues involvement in sinuses was observed in 21% of children, 13% of adolescents, and 14% of adults. In all the three groups, the most prevalent symptom of fracture was the hematoma or soft tissues in sinuses. The prevalence of fractures varied in different seasons and months of the year, as maximum fractures occurred in July-August (23%), and minimum fractures occurred in January-March (0.6%). The summer season with 53% of reported fractures was the most eventful period of the year.

Discussion

The present study on traumatic patients of Mashhad's Shahid Kamyab Emergency Hospital revealed that 85% of the maxillofacial fractures occurred in adults, and 15% of the fractures occurred in adolescents and children. This result conformed to that of Vya's study conducted on maxillofacial fractures of adolescents and children in California, USA (5). Moreover, Gadre in India (3), Adeyemo in Nigeria (6) and Qudah in Jordan (7) reported the most frequent fractures in adults. This result is the consequence of the

cause of maxillofacial fractures of which the most frequent in Iran is car accident.

In the present study, the most common cause of fractures was car accident with a much higher percentage than that of other causes (70% to 30%). This result agreed with that of studies by Gadre in India (3) Khorasani in Qazvin, Iran (8), Kadkhodaie in Rasht, Iran (4), Chandra in India (9), Adeyemo in Nigeria (6), Qudah in Jordan (7). However, Rood in South Africa (10) and Malara in Poland (11) reported the quarrels as the most frequent cause of maxillofacial fractures. The quarrels were also a major cause of maxillofacial fractures in the U.S., Australia, and France (5). This indicated that developed countries had drawn upon successful strategies for reducing accidents. Car accidents were the most prevalent cause of fractures in adolescents of the present study. This result was the same as that obtained in Brazil (12). Similar to the studies performed by Adeyemo in Nigeria (6), Qudah in Jordan (7), and Scariot in Brazil (12) and Zhou in Korea (13) the present study showed that fallings were significantly more prevalent than other causes in the child group which might be due to children's failure to concentrate on their motor activities.

Although the fracture of mandible was rather highly prevalent (7.6%) in this study, the most frequent fracture site in adults was the nasal bone, then, ZMC (14-16). The studies by Gadre(3), Kadkhodai (4), Rood (10), Adeyemo (6), and Qudah (7) reported mandible as the most frequent fracture site in adults. The reason might be that when mandibular fracture is detected in extraoral radiographs, which are mainly panoramic, patients, do not undergo CT scan imaging. Therefore, it is noteworthy to mention that all traumatic patients, even those without specific clinical symptoms, should be undergone CT scan imaging.

Based on the results of this study, the most frequent fracture site in adolescents was the nasal bone. This result conformed to that of Cavalcanti (17) and Kim's study (18). However, the studies by Chrcanovic (19), Imahara (20), and Oqunlewe (21) showed mandible, then, the nasal bone as the most frequent fracture sites. It should be mentioned that the nasal bone is the most raised and elegant facial bone, so that, it might fracture simultaneous to other midface fractures.

In the present study, there was a statistically significant correlation between the site and the cause of fractures in males, as the nasal bone mostly fractured in accidents and quarrels, and mandible mostly fractured in fallings. In children, whose major cause of maxillofacial fractures was the falling, mandible fractured more than other bones. This might be due to the prominence of the chin bone colliding with the ground. People may unconsciously avoid facing with the ground when falling, and consequently, they inhibit the nasal bone fracture.

The results of this study revealed that the body of the mandible significantly fractured more than other parts of the bone. The condylar part was the second most frequent fracture site of mandible. This result agreed with that of the studies by Adeyemo (6), Qudah (7) and Khorasani (8). Moreover, Chapman introduced condyle as the most frequent fracture site of mandible (22). The reason might be that Chapman had classified the parasymphyseal region apart from the body, while, studies similar to the present study considered the parasymphyseal region as a part of the body.

Scariot also introduced the condylar region as the most frequent site for mandibular fracture in children (12). This might be due to the weakness of the subcondylar region in children and requires more comprehensive studies.

In the present study and Hwang's study (23), the orbital floor fracture was the most significantly frequent fracture in adults and adolescents. In Chapman's study, the orbital roof fracture was frequent more than other maxillofacial fractures in people younger than 17 years old (22). In the present study, the most frequent orbital fracture in children occurred in the orbital roof. This might be due to the incomplete pneumatisation of maxillary sinus in childhood that results in thicker orbital floor in children than that in adults.

In all the three groups of this study, the incidence of posttraumatic hematoma or soft tissues in maxillary sinus was more frequent than other conditions. The reason might be that the maxillary sinus would be involved in many midface fractures, such as ZMC, nasal bone, and orbital floor fractures, and because of its cavity-like shape, hematoma is stored in it.

Considering that Mashhad is a tourist attraction, the most frequent causes of fractures in this study was car accidents, and most people went on a trip in summer, the incidents resulting in the fractures mostly occurred in summer.

It can be concluded that car accidents were the major risk factor of fractures in Mashhad. The causes, sites, and patterns of maxillofacial fractures varied in the three groups of children, adolescents, and adults. The most frequent cause and site of maxillofacial fracture in children were, respectively, fallings and the mandible. However, the most frequent cause and site of maxillofacial fracture in adults and adolescents were car accidents and the nasal bone, respectively. The cause and site of fractures in children differed from those of adults and adolescents. The pattern of fracture in adolescents was similar to that in adults.

Given that car accidents are the main cause of fractures in Iran, promoting the culture of driving and recommending drivers to follow traffic rules and

regulations and use safety belt can reduce severity of injuries and, consequently, fractures in patients. Preventing children from falling as much as possible is way of reducing maxillofacial fractures.

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