Original Article

Multi Center Computer Guided Analysis of Site Distribution in Isolated Mandibular Fracture

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ABSTRACT

Objective: To determine the site distribution in isolated mandible fracture using multi center computer guided analysis among patients presenting at tertiary care hospital of Karachi, Pakistan.

Study Design: Descriptive / cross sectional study

Place and Duration of Study: This study was conducted at multicenter Tertiary Care Hospitals in Karachi from 1-1-2021 to 1-7-2021.

Materials and Methods: Data was collected after obtaining ethical approval from institutional ethical review committee. Verbal informed consent was obtained. Total of 500 OPGs (Orthopantomagram) from various tertiary care hospitals in Karachi were collected. Data was collected in the form of radiographs or soft copies in a removable storage device. Computer based analysis of OPGs were done. The collected OPGs were assessed for lines of propagation of fracture and pattern of mandibles fractures. All data were collected and noted on a pre-designed profarma by researcher.

Results: Average age of patients was 30.37±12.37 years. Out of 500 patients 344(69%) were male and 156(31%) were female patients. Most common sites of mandibular fracture were parasymphysis 118(23.6%), body 79(15.8%), sub-condyle 70(14%), angle 48(9.6%) while in multiple site fractures symphysis/parasymphysis was the frequent combination 37(7.4%).

Conclusion: Majority of young male patients suffered from mandibular fractures. RTA (road traffic accident) was the most prevalent cause of mandibular fracture, followed by falls. Parasymphysis, body and sub-condyle were the most frequently fractured sites.

Key Words: Isolated mandibular fracture, site distribution, etiology, RTA, fall, trauma.

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INTRODUCTION

The mandible is the lowest facial bone that is important for both functional and anatomical structure.[1] The 'parasympysis', 'symphysis', 'body',' condyle', 'angle', 'ramus', 'coronoid', and 'alveolus' are anatomic segments of the mandible.[2] Mandible fractures is 2nd most common fractures caused by trauma.[3]

These fractures are prevalent in young males due to more taking part in outside activities[4], and account for 36 to 59% of all maxillofacial fractures, as per evidence. it is the 10th most often damaged bone in the human body and it is broken two to three times more frequently than other facial bones.[5] Vehicle accidents and violent confrontations are the leading causes of mandibular fractures worldwide, followed by work injuries, sporting activities, or falls/crashes. Mandible fractures are three times more common in males than women. The majority of these cases occur in the 2nd or 3rd stones of life. More than 50% of the patients had multiple fractures, because of its ring-like shape. A parasymphyseal region with a sub-condylar or contra lateral angle fracture is the most prevalent combination of injuries. Mandibular fractures are generally caused by trauma. This might include a chinstrap fall or a side collision. The condyle, body, angle, and symphysis are the most frequently fractured areas.[6] The most common fracture location in vehicle accidents was the condyle, in motorcycle accidents was the symphysis. The most commonly broken location in assault situations is the angle.[7] Whereas an X-ray can be used to offer a good diagnosis in some cases, modern CT scans are more accurate and consistent.[6] Greenstick fractures are the most common type of fracture.[3,8] A prior research in Pakistan found that 43% of patients had isolated

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mandibular fractures, with the parasymphysis 35% and condyle being the most common sites of fracture.[9]

Due to limited recent evidence available on the site of mandibular fractures in the Pakistani population, therefore the target of present research is to determine the sites distribution in isolated mandibular fracture by multi-center computer-guided analysis among patients presenting at Karachi Tertiary Care Hospital, Pakistan. This study will be beneficial in assessing the quality of patient treatment and developing preventive strategies.

MATERIALS AND METHODS

Descriptive cross-sectional study was conducted at (multicenter) tertiary care hospital of Karachi, Pakistan from 1-1-2021 to 1-7-2021 after the approval of synopsis from institutional research ethics committee.

The sampling technique was non-probability convenience sampling. Sample size was estimated using Open Epi online sample size calculator by taking statistics of Symphysis site of fracture as 3.8%(38), bond on error as 1.7% and 95% confidence level. The estimated sample size is 486≈500.We included Patients of age 15-60 years, either gender, edentulous patients presenting with isolated mandibular fracture and willing to take part in the study and were excluded those Patients with pre-existing pathology, Patients with hematological discrepancies, Patients undergoing radiotherapy/chemotherapy.

The data was collected through pre-designed profarma after getting verbal informed permission from eligible patients, in the form of radiographs or soft copies in a removable storage device. The collected OPGs were assessed for lines of propagation of fracture and pattern of mandibular fractures (i.e. sites, causes and nature of fractures). Data regarding age, gender, anatomical location, number of fracture, degree of fracture fragment displacement, localization and charter were also be collected.

Data was analyzed using SPSS version 24. Mean and standard deviation were computed for quantitative variables. Frequency and percentage were computed for qualitative variables. Effect modifiers were addressed through stratification. Post stratification Chi square test was applied. P-value less than or equal to 0.05 was considered as statistically significant.

RESULTS

Total 500 OPGs of patients with isolated mandible fracture were evaluated for fracture sites distribution. Comparisons of sites of fracture were done with age, gender and etiology. The association found highly significant with P-value 0.000

Table 1 demonstrates the comparison of gender with etiology of fracture that majority of patients with mandible fractures were male 69% and 31% were female patients. Etiological distribution showed that RTA was the most frequent cause 44.6% of fracture among these patients followed by fall 38%. Less frequent causes were sports related injuries 10.2% and assaults 7.2%. Comparison of gender with etiologies done; most of the male patients 66.8% were with RTA and 33.2% were female. Similarly for fall, sports injuries also dominant for male gender 96.1%, there was no major difference found in assault proportion with respect to gender. The comparison showed significant difference with P-value: 0.000.

Table No.1: Comparison of gender with etiology of fracture

Etiology	Gender		Total	p-value*
	Female	Male		
Assault	17(47.2%)	19(52.8%)	36(100%)	0.000
Fall	63(33.2%)	127(66.8%)	190(100%)	
RTA	74(33.2%)	149(66.8%)	223(100%)	
Sports	2(3.9%)	49(96.1%)	51(100%)	
Total	156(31.2%)	344(68.8%)	500(100%)	

*Chi square test

Table 2 showed the comparison of site of fracture with age groups and gender. Average age of patients was 30.37±12.37 years with range of (15-60) years. Most of the subjects 54.6% age was 25 years or less, and 27.6% were 26-45 years of age, and very few were belong from older age group (more than 45) 17.8%. Among younger 25 years or less than 25years of patients most frequent fracture site were Parasymphysis 27.1%, sub-condyle 19%, angle 12.1%, and body 8.8%. In middle age group 26-45 years most common sites were reported body 14.5%, symphysis 13%, sub-condyle 13%, angle 10.9%. In older age (more than 45 years) patients frequent facture reported were body 39.3% and parasymphysis 33.7 %. The comparison showed significant difference with P-value: 0.000.

Table 2 also explains the distribution of sites of fracture with gender. The most common site of mandible fracturein both male and female was parasymphysis 23.6%, followed by body 15.8%, sub-condyle 14%, angle 9.6% while in multiple site fractures symphysis/ parasymphysis was the frequent combination 7.4% other less frequent sites and combinations were stated in table 2. Male gender had the following frequent fractures parasymphysis 26.7%, sub-condyle 18% and body 12.8% while in female patients body 22.4% parasymphysis 16.7% and angle 15.4% were the most common affected sites. The comparison showed significant difference with P-value: 0.000.

Table 3 demonstrates the comparison of site of fracture with etiology. In patients with RTA sub-condyle 20.6%, parasymphysis 16.6% and body 15.7% were the common sites affected. Patients with the history of fall showed the frequent fracture sites; body 18.9% and angle 12.6%, Symphysis/parasymphysis 30.6% were the most common sites of fracture result in assaults, and sports injury patients had sub-condyle 47.1%, condyle 33.3% and angle 19.6%. The comparison showed significant difference with P-value: 0.000

Table No.2 Comparison of site of fracture with age groups & gender

Site of fracture	Age groups in years n(%)			Total n(%)	*p-value	Gender n(%)		Total n(%)	*P-value
	25 or less	26-45	>45			Female	Male		
Angle	33(12.1)	15(10.9)	0(0)	48(9.6)	0.000	24(15.4)	24(7)	48(9.6)	0.000
Body	24(8.8)	20(14.5)	35(39.3)	79(15.8)		35(22.4)	44(12.8)	79(15.8)	
Condyle	18(6.6)	4(2.9)	9(10.1)	31(6.2)		13(8.3)	18(5.2)	31(6.2)	
Coronoid	5(1.8)	0(0.0)	4(4.5)	9(1.8)		4(2.6)	5(1.5)	9(1.8)	
Parasymphysis	74(27.1)	14(10.1)	30(33.7)	118(23.6)		26(16.7)	92(26.7)	118(23.6)	
Sub- Condyle	52(19)	18(13)	0(0.0)	70(14)		8(5.1)	62(18)	70(14)	
Symphysis	18(6.6)	18(13)	0(0.0)	36(7.2)		10(6.4)	26(7.6)	36(7.)	
Symphysis/ Parasymphysis	18(6.6)	8(5.8)	11(12.4)	37(7.4)		12(7.7)	25(7.3)	37(7.4)	
Body/ Parasymphysis	13(4.8)	0(0.0)	0(0.0)	13(2.6)		9(5.8)	4(1.2)	13(2.6)	
Condyle/ Parasymphysis	0(0.0)	2(1.4)	0(0.0)	2(0.4)		2(1.3)	0(0)	2(0.4)	
Condyle/ Sub-Condyle	0(0.0)	8(5.8)	0(0.0)	8(1.6)		4(2.6)	4(1.2)	8(1.6)	
Ramus/ Parasymphysis	0(0.0)	15(10.9)	0(0.0)	15(3)		0(0)	15(4.4)	15(3)	
Ramus/ Symphysis	0(0.0)	14(10.1)	0(0.0)	14(2.8)		5(3.2)	9(2.6)	14(2.8)	
Angle/ Sub-Condyle/ Symphysis	10(3.7)	0(0.0)	0(0.0)	10(2)		1(0.6)	9(2.6)	10(2)	
Condyle/ Symphysis/Parasymphysis	0(0.0)	2(1.4)	0(0.0)	2(0.4)		0(0)	2(0.6)	2(0.4)	
Ramus/ Symphysis/Parasymphysis	8(2.9)	0(0.0)	0(0.0)	8(1.6)		3(1.9)	5(1.5)	8(1.6)	
Total	273(100)	138(100)	89(100)	500(100)		156(100)	344(100)	500(100)	

*Chi square test

Table No.3: Comparison of site of fracture with etiology

Site of fracture	Etiology				Total n(%)	p-value*
	Assault	Fall	RTA	Sports		
Angle	0(0%)	24(12.6%)	14(6.3%)	10(19.6%)	48(9.6%)	0.000
Body	8(22.2%)	36(18.9%)	35(15.7%)	0(0%)	79(15.8%)	
Condyle	0(0%)	14(7.4%)	0(0%)	17(33.3%)	31(6.2%)	
Coronoid	0(0%)	9(4.7%)	0(0%)	0(0%)	9(1.8%)	
Parasymphysis	5(13.9%)	76(40%)	37(16.6%)	0(0%)	118(23.6%)	
Sub-Condyle	0(0%)	0(0%)	46(20.6%)	24(47.1%)	70(14%)	
Symphysis	0(0%)	16(8.4%)	20(9%)	0(0%)	36(7.2%)	
Body/ Parasymphysis	4(11.1%)	0(0%)	9(4%)	0(0%)	13(2.6%)	
Condyle/ Parasymphysis	0(0%)	0(0%)	2(0.9%)	0(0%)	2(0.4%)	
Condyle/ Sub-Condyle	8(22.2%)	0(0%)	0(0%)	0(0%)	8(1.6%)	
Ramus/ Parasymphysis	0(0%)	0(0%)	15(6.7%)	0(0%)	15(3%)	
Ramus/ Symphysis	0(0%)	0(0%)	14(6.3%)	0(0%)	14(2.8%)	
Symphysis/ Parasymphysis	11(30.6%)	6(3.2%)	20(9%)	0(0%)	37(7.4%)	
Angle/ Sub-Condyle/Symphysis	0(0%)	1(0.5%)	9(4%)	0(0%)	10(2%)	
Condyle/ Symphysis/ Parasymphysis	0(0%)	0(0%)	2(0.9%)	0(0%)	2(0.4%)	
Ramus/ Symphysis/ Parasymphysis	0(0%)	8(4.2%)	0(0%)	0(0%)	8(1.6%)	
Total	36(100%)	190(100%)	223(100%)	51(100%)	500(100%)	

***Chi square test**

Table 4 elaborates the characteristics of fracture in study participants. The most common type was impacted fracture in 40.4% patients, greenstick was found in 22% patients, complex fracture was found in 19.4% patients, comminuted fracture alone found in 8.4% while with complex fracture found in 2% patients. Most of the patient's status of fracture was unfavorable 69.4% and only 30.6% patients had favorable status. Almost half of the patients 48.8% had simple fractures while 33.6% patients had compound fractures, 10.4% patients had comminuted fractures and only 7.2% had closed fractures. Direction of fracture were horizontal and vertical both direction's proportion was equal with 48% remaining 3% patients had direction horizontal to vertical and only 0.4 patients had direction was vertical to horizontal.

Table No.4: Characteristics of fractures among participants

Characteristics of fracture	n(%)	Total n(%)
Types of fractures		
Impacted	202(40.4%)	
Green stick	110(22%)	
Complex	97(19.4%)	500(100)
Comminuted	42(8.4%)	
Depressed fracture	37(7.4%)	
Comminuted/Complex	10(2%)	
Impacted/Complex	2(0.2%)	
Status of fracture		
Unfavorable	347(69.4%)	
Favorable	153(30.6%)	500(100)
Severity of fracture		
Simple	244(48.8%)	
Compound	168(33.6%)	500(100)
Comminuted	52(10.4%)	
Closed	36(7.2%)	
Direction of fractures		
Vertical	243(48.6%)	
Horizontal	240(48%)	500(100)
Horizontal /Vertical	15(3%)	
Vertical/ Horizontal	2(0.4%)	
charter distribution of fracture	317(63.4%)	
Fracture with dislocation	183(36.6%)	500(100)
Fracture without dislocation		
Laterality status of fracture	350(70%)	500(100)
Unilateral	150(30%)	
Bilateral		
Number of fracture in a patient	275(55%)	
Single	142(128.4%)	500(100)
Double	83(16.6%)	
Multiple		

Charter distribution showed that 63.4 patients were with dislocation and 36.9% patients were without dislocation. 70% patients were with unilateral fracture and 30% patients had bilateral fracture. Most of the patients had single fractures 55%, 28.4% patients had double and 16.6% patients had multiple fractures.

DISCUSSION

In this study, we investigated isolated mandibular fractures treated in Karachi at several tertiary care hospitals. The purpose of this research is to provide in-depth details concerning fracture sites, as well as etiological aspects and other fracture-related features reported. The findings of this research are consistent with earlier publications, especially in terms of patient age, gender, and etiology.[10,11] Mandibular fractures are most common in those aged 15 to 25 years old, according to our research 54.6 %. This may be due to increased usage of two- wheelers, inexperienced riders, poor safety precautions such as helmets, and poor road conditions may all be contributing factors in our geographic region, given the majority of fractures in this category are RTAs. Despite the male dominance, the distribution of gender in our analysis indicated a male to female ratio of about 7:3, which is consistent with other studies. This indicates that female involvement in maxillofacial trauma is on increasing might be due to increased female mobility and social involvement. The exact cause of maxillofacial trauma differs dramatically between developing and developed countries. In underdeveloped nations, RTAs are the most prevalent etiology, whereas assault is the most common cause in developed countries. RTA was the cause of injury in 44.6% of our patients, which was comparable to the existing literature.[12,13] When age and gender were taken into account, patients with mandible fractures in our research were predominantly young men, which matched the findings in the literature.[12,14,15] The most prevalent locations of mandibular fracture, according to the present research were Parasymphysis region 118(23.6%). The type of trauma and etiologic variables are essential in determining the location of mandible fractures. In traffic accidents, on the other hand, the Parasymphysis region is the most affected.[5,12,13,16] Fridrich et al indicated that mandibular fractures site Symphysis and Parasymphysis are mostly seen in the motor vehicle accidents. Moreover, Mandibular fractures induced by assault were most commonly found in the angle. The most common fracture locations were the symphysis and parasymphysis, accounting for 39% of all fractures, these evidences are consistence with our research.[7,17] Females are more likely than males to suffer a mandibular angle fracture (47.9% vs. 23.6%), and this difference is statistically significant $P< 0.001$.[4]. Another research reveals that female patients with mandibular injuries had a greater rate of angle involvement than

male patients.[19] On the other hand, Patel et al.[19] Males are more likely than females to experience from mandibular angle fractures, according to the study. In this research analysis, male patients had 26.7% Parasymphysis whereas female patients had the Body 22.4% body fractures.

When the anatomic distribution of fractures is examined independently of the type of trauma, the most frequent sites are the Condyle, Angulus and Symphysis/parasymphasis region.[20,21] It's important to note that the Condyle and sub-condyle areas of the mandible are the most difficult to analyze, and fractures in these locations can be difficult to diagnose, similar to our study. The commonly affected site found was Parasymphysis.[13] The researches were carried out by Barde D et al[10] & Adi et al[22] also agree with our finding.[22]

CONCLUSION

The majority of patients who had mandibular fractures were young male. RTA was the most prevalent etiological cause, and the Parasymphysis was the most commonly fractured site. In underdeveloped nations like Pakistan, RTAs are still responsible for a significant incidence of mandibular fractures. The current mandibular fracture assessments were useful to government organizations and health-care professionals designing future preventive and treatment initiatives.

Recommendation: It is imperative to begin public educational programmes on the traffic rules, wearing a helmet etc. to reduce the RTAs, according to our data, RTAs are the leading cause of maxillofacial fractures. In compared to other injuries, mandibular fractures can cost a lot of money in terms of medical expenses.

Author's Contribution:

Concept & Design of Study:	Hira Zaheer, Farhat Jafri
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