

Symphyseal Injuries as Indices for Condylar Fractures Diagnosis

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Aims: The mechanism of condylar fractures and indices for diagnosis are complex hence the aim of this study was to investigate the influence of various injuries in the symphyseal region on condylar fracture patterns and correlating it with diagnosis.

Study Design: Prospective study.

Place and Duration of Study: Oral and Maxillofacial clinic of University of Uyo Teaching hospital, Uyo Nigeria from February 2014 to January 2020.

Methodology: The study included 111 patients with condylar fractures associated with varying degrees of symphyseal injuries. Data on age, sex, soft tissue injuries, and symphyseal fractures were collated and analyzed using multivariate logistic regression.

Results: Age range 21-30 years had the highest occurrence of condylar fracture with males having more condylar fractures than females. Contusion has more association with condylar fractures followed by hard tissue fracture at the symphysis with a frequency of 38 (34.23%) while abrasion showed the injury with the least impact. Majority of the impact resulted in unilateral condylar fractures with a frequency of 62 (55.86%). Condylar fractures at the level of the condylar neck was more prevalent than at the level of the condylar head with the head showing only a frequency of 40 (36.04%) as against 71 (69.96%) for condylar neck fractures

Conclusion: The occurrence of mandibular fractures is strongly correlated with age, sex, soft tissue injuries and hard tissue injuries at the symphysis. Overall, contusion gave more of unilateral fractures while fracture at the symphysis resulted in more of bilateral condylar fractures.

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1. INTRODUCTION

Mandibular symphyseal fracture accounts for 15.6 to 29.3% of mandibular fractures [1]. The main causes of facial fractures are road traffic accidents, assaults, and sports-related injuries. Condylar fractures account for 17.5–52.0% of all mandibular fractures [2]. Studies of condylar fractures consistently updating etiological information [3,4,5,6]. Zhou et al. [4] reported that the location of mandibular fractures is strongly correlated with age, sex, and soft-tissue injuries. However, most of the studies lack information about the influence of the nature of the injuries on the fracture site.

Considering that morphological variation is a factor that could influence fracture type, the purpose of this study was to evaluate the relationship between condylar fracture and the impact from various symphyseal injuries. A comprehensive understanding of the various degrees of injuries in the symphyseal region and factors that influence the involvement of condylar fractures may provide new guidelines and indices for assessing the involvement of such fractures.

Studies have described the distribution of compressive forces and tensile stresses and reported the presence of potentially weak areas in the mandibular geometry. Huelke and Harger [7] found that fractures occur more readily under tension than compression. In the case of a frontal blow, a jaw with fracture at the impact point acts like a lever [8]. The compressive stress is mainly distributed in the mandibular angle and posterior aspect of the condyle bilaterally through the mandibular body and ramus axis, in addition to the impact point. Xin et al. reported that condylar head fractures after parasymphiseal impact are related to the anatomical features of the condyles [9].

Although the mandibular condyle is one of the most common sites of injury to the facial skeleton, it is also the most overlooked and least diagnosed site of trauma in the head and neck region. In terms of strength, the condylar neck constitutes the weakest region of the entire mandible and is therefore the most susceptible to fracture. Because of the well protected position of the condylar process, however, injuries are often the result of indirect forces, where the forces of impact are transmitted along the mandible from distant sites such as the angle, body or symphysis to the condylar neck [10,11].

The mechanism of condylar fractures and indices for diagnosis are complex hence the objective of this study was to investigate the influence of various injuries in the symphyseal region on condylar fracture patterns and characteristics and correlating it with diagnosis.

2. METHODOLOGY

2.1 Study Design

This was a prospective study carried out at the oral and maxillofacial clinic of University of Uyo Teaching hospital, Uyo Nigeria from February 2014 to January 2020.

Method: We analyzed the data of 111 patients who presented with condylar fractures associated with varying degrees of symphyseal injuries. The age range was from 0 to 70 years. Good history taking, thorough physical examination, and radiological imaging was done. Patients were investigated and diagnosed for various degrees of injuries. Computerised Tomography (CT) scan and plain radiograph was used for investigation and diagnosis. Facial bone CT scan was done to determine mandibular and condylar fracture. This was corroborated with reports from radiologists. Symphyseal fracture was defined as fracture line in mandibular bone between the canine teeth.

2.2 Inclusion and Exclusion Criteria

Inclusion criteria for the study were condylar fractures associated to symphyseal injuries which included soft tissues injuries such as laceration, contusion, abrasion as well as hard tissue injuries which included fractures of the mandible at the symphyseal region. All patients with condylar fractures associated with isolated soft tissues injuries such as laceration, contusion, abrasion participated in this study. Those with combination of injuries at the symphysis were excluded. Condylar fractures from malignancy or congenital malformation and those without injuries in the symphysis were also excluded.

2.3 Statistical Analysis

95% confidence interval (CIs) for the associations between selected parameters and condylar fracture patterns. We evaluated the associations between each parameter and the

types of condylar fractures (condylar head fracture and condylar neck fracture, Unilateral and bilateral fractures). All the data were analyzed using SPSS software version 21.0 (IBM, Chicago, IL, USA). A value of $P < .05$ was considered statistically significant. The data were analyzed through multivariate logistic regression.

3. RESULTS

3.1 Age and Gender Distribution

The result shows that age range 21-30 years had the highest occurrence of condylar fracture, while the least was in the age range 0-10 years with 4.50% injuries on as shown in Table 1. The gender distribution with a higher percentage in male than female.

Table 1. Age and Gender distribution

Age	Frequency (n)	Percentage
0-10	2	3.60
11-20	5	4.50
21-30	45	40.54
31-40	31	27.93
41-50	12	10.81
51-60	11	9.91
61-70	5	4.50
Gender		
Male	89	80.18
Female	22	19.82
Total	111	100

3.2 Nature of Injuries on the Symphysis

Contusion was shown to be more associated with condylar fractures with a prevalence of 55 (49.55%). This is distantly followed by hard tissue fracture at the symphysis with a frequency of 38 (34.23%) while abrasion showed the injury with the least impact.

3.3 Nature of Condylar Fractures

Majority of the impact resulted in unilateral condylar fractures with a frequency of 62 (55.86%) as depicted in Fig. 1.

3.4 Site of Condylar Fractures

Condylar fractures at the level of the condylar neck was more prevalent than at the level of the condylar head with the head showing only a frequency of 40 (36.04%) as against 71 (69.96%) for condylar neck fractures (Fig. 2).

Table 2. Nature of Injuries on the symphysis

Nature of injury	Frequency	Percentage
Laceration	12	10.81
Abrasion	6	5.41
Contusion	55	49.55
Symphyseal fracture	38	34.23
Total	111	100

3.5 Multivariate Logistic Regression Analysis of Patients with Condylar Fractures

Table 3 shows multivariate relationship between condylar fractures and various types of injuries at the symphysis. There is a positive association between male patients and condylar fractures (OR, 1.360; 95% CI: 1.101-2,115). Contusion has a high positive association with condylar fracture (OR, 3.270;95% CI: 2.246-4.782). This is followed by impact from fracture at the symphysis with OR, 2.062; 95% CI: 1.222-3.278. Male patients had greater risk of condylar fractures arising from related injuries in the symphysis (OR, 1.360; 95% CI, 1.101-2.115).

3.6 Multivariate Logistic Regression Analysis of Patients with Unilateral and Bilateral Condylar Fractures

Concerning gender as shown in Table 4, unilateral condylar head fracture is positively associated with male gender with OR = 1.152, 95% CI: 1.099-1.110 compared to females which was negatively associated with condylar head fracture with OR= 0.158 , 95% CI: 0.113-0.423 .Unilateral condylar fracture is also positively associated with contusion and negatively related to symphysis fracture (OR, 0.152; 95% CI:0.122-0.278). Analysis of the relationship with bilateral condylar fractures shows that female gender, laceration and abrasion are negatively associated with bilateral condylar fracture .Patients with these injuries were at low risk (OR< 1) of bilateral condylar fractures while male gender shows a positive association (OR, 1.74, 95% CI: 1.221-2.725).

3.7 Influence of Each Parameter on Condylar Head and Neck Fracture

Tables 5 illustrates the influence of the variables on condylar head fractures. Male had positive

association with condylar head (OR, 2.112; 95% CI=1.231-2.612. Contusion and symphysis fractures were also highly associated with head fractures. It also illustrates the influence of the

variables on condylar neck fractures. Female had positive association with condylar neck fractures. This is an indication that in females, neck fractures are more prevalent.

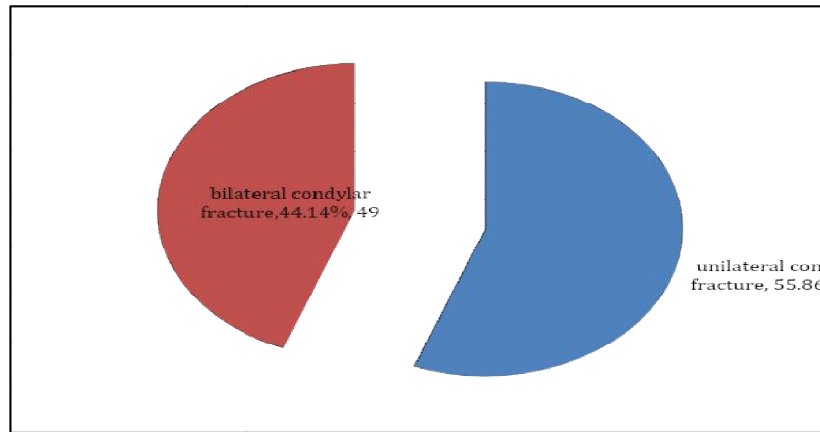


Fig. 1. Nature of condylar fractures

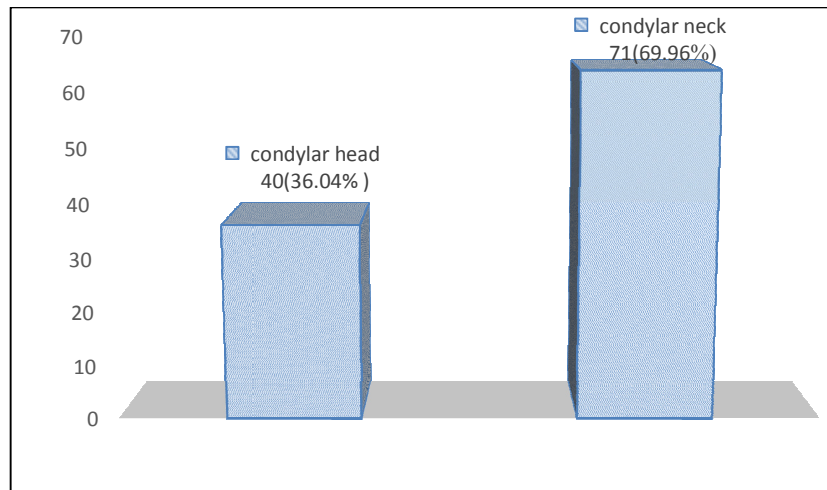


Fig. 2. Site of condylar fractures

Table 3. Multivariate logistic regression analysis of patients with condylar fractures

Parameters	Number (n)	OR	(95% CI)	p value
Male	89	1.360	(1.101-2.115)	0.011*
Female	22	0.270	(0.223-0.615)	0.542
Laceration	12	0.170	(0.040-0.194)	0.761
Abrasion	6	0.086	(0.030-0.183)	0.528
Contusion	55	3.270	(2.246-4.782)	0.012*
Symphysis Fracture	38	2.062	(1.222-3.278)	0.013*
Unilateral condylar fracture	62	2.809	(1.923-3.381)	0.034*
Bilateral condylar fracture	49	1.903	(1.316-2.774)	0.001*

*P<.05. 95% CIs, ORs: The association between parameters and condylar fracture. ORs: Odds ratios; CIs: Confidence intervals, P: P values for all variables

Table 4. Multivariate logistic regression analysis of patients with unilateral and bilateral condylar fractures

Parameters	Number (n)	OR	(95% CI)	p value
Unilateral condylar fractures				
Male	89	1.152	(1.099-1.110)	0.003*
Female	22	0.158	(0.113-0.423)	0.613
Laceration	12	0.113	(0.050-0.191)	0.711
Abrasion	6	0.045	(0.020-0.183)	0.818
Contusion	55	1.255	(1.238-3.870)	0.001*
Symphysis Fracture	38	0.152	(0.122-0.278)	0.642
Bilateral condylar fractures				
Male	89	1.74	(1.221-2.725)	0.024*
Female	22	0.162	(0.211-0.421)	0.653.
Laceration	12	0.178	(0.031-0.172)	0.851
Abrasion	6	0.026	(0.041-0.180)	0.501
Contusion	55	1.281	(2.206-3.912)	0.003*
Symphysis Fracture	38	3.152	(2.242-4.251)	0.001*

* $P < 0.05$. 95% CIs, ORs: The association between parameters and condylar fracture. ORs: Odds ratios; CIs: Confidence intervals, P: P values for all variables

Table 5. Influence of each parameter on condylar head and neck fracture

Parameters	Number (n)	OR	(95% CI)	p value
Condylar head fracture				
Male	89	2.112	(1.231-2.612)	0.001*
Female	22	0.262	(0.210-0.320)	0.070
Laceration	12	0.145	(0.011-0.164)	0.071
Abrasion	6	0.016	(0.021-0.190)	0.082
Contusion	55	1.111	(1.012-3.412)	0.003*
Symphysis Fracture	38	2.112	(1.322-3.001)	0.001*
Condylar neck fracture				
Male	89	0.174	(0.013-2.621)	0.061
Female	22	1.67	(1.221-2.421)	0.001*
Laceration	12	0.011	(0.011-0.152)	0.102
Abrasion	6	1.555	(1.334-3.190)	0.003*
Contusion	55	1.970	(1.780-2.531)	0.001*
Symphysis Fracture	38	3.152	(2.222-4.130)	*0.005

* $P < 0.05$. 95% CIs, ORs: The association between parameters and condylar fracture. ORs: Odds ratios; CIs: Confidence intervals, P: P values for all variables

4. DISCUSSION

This study evaluated the correlation of various factors involved in condylar fractures. Results showed that the occurrence of condylar fractures was highly correlated with the age, sex, soft and hard tissue injuries. Logistic regression analysis was used to control confounding variables.

This study shows that commonest age group was age range 21-30, closely followed by 31-40. This agrees with previous studies on condylar fractures which reported adult cases to be higher

than paediatric cases [12]. It was also reported that fractures of mandibular joint processes most often appear in patients in their third decade of life [13,14,15]. While in this study it was reported that only 3.60% in age range 0-10 of the patients with condylar fractures were children, previous studies have recorded condylar fractures to be more frequent in that age range than reported in this study [13]. Also, in a study done by Iida and Matsuya, condylar fractures were more frequent in children < 14 years of age, especially those below 6 years [16]. In another study, condylar fractures age groups ranged between 17 and 32 years of age [17].

The reason may be that paediatric mandible is pliable and can easily withstand stress from impact on the chin. Such impact is transmitted to the condyle which is less resistant to stress being the growth point of the mandible.

In this study, males to female's ratio was 4:1 where males constituted (80.81%) of the total cases. This is in agreement with previous studies with male preponderance. Badar and Syed [18]. It also agrees with a study by Mahgoub et.al who reported a male to female ratio of 5.7:1. This ratio in favour of male is because they are more involved in common etiological factors of fractures. In contrast to this, Zachariades et al., found no significant difference between males and females in condylar fractures [2].

Fractures of the condylar neck and head regions often occur at the time of injury because some of the impacting force is transmitted along the mandible to its weakest link, that is, the condylar neck and head areas.

The study reported that condylar neck fractures was more common of the fractures (59.7%), than condylar head fractures came second (28.8%). This is in agreement with a study by Reddy who showed that condylar neck fractures were the most common type of fracture [19]. This may be due to the fact that the weakest point of the condyle is at the neck.

The condylar neck constitutes the weakest region of the entire mandible and is therefore the most susceptible to fracture. Because of the well protected position of the condylar process, however, injuries are often the result of indirect forces, where the forces of impact are transmitted along the mandible from distant sites such as the angle, body or symphysis to the condylar neck [20,21]. The greater fragility of condylar neck and biomechanical mechanisms could explain this phenomenon. The condylar neck is a weak point of mandible, and some studies using a simulated standard frontal impact acting on symphysis region have indicated that there is a concentration of stress on the condylar neck [22,23]. Hence, in our opinion, the more narrow condylar neck is more liable to fracture than the condylar head.

Most of the injuries in this study is unilateral. This is in agreement with a previous study [2,24,25]. In contrast to this report, previous studies

revealed bilateral condylar fractures occurs more than unilateral condylar fracture [26,27]. A close relationship was revealed between condylar fracture and other injuries at the symphysis. Patients with condylar fractures frequently had symphyseal contusion and fractures.

We found a negative correlation suggesting that condylar fracture tended to have less of an association with abrasion and laceration and more from contusion and symphyseal fractures. Presently, little is known about the mechanics in the production of condylar fractures from injuries at the symphysis especially soft tissue injuries.

The present study showed that bilateral condylar fractures was more than unilateral fractures. The multivariate analysis revealed that the male gender, symphysis fractures and contusion injuries were positively associated with condylar fractures (OR >1). These types of injuries tend to have more impact on the mandible and hence able to generate enough force on the condyle.

Contusion injuries have a positive relationship with condylar fractures (OR >1), this shows that contusion is more likely to cause condylar fracture than other types of injuries. It was observed in the study that contusion is positively associated with unilateral condylar fractures. This suggests that contusion leads to more unilateral condylar fractures than symphyseal fractures. However, symphyseal fractures gave more bilateral fractures.

This is in contrast with a previous report which says that patients with symphysis fracture were associated with a low risk of bilateral condylar fractures [4].

These results are contradictory but interesting. The biomechanics of symphysis fracture is simple; with the application of an external force on the labial side of the symphysis, tensile strain is produced through flattening of the chin and concomitant stretching of the lingual cortical plate [28]. Under these circumstances, fracture of the symphysis occurs more commonly, only a great force applied to the symphysis can pass through the mandibular arch; this phenomenon leads to bilateral condylar fractures. This study revealed that injuries that can cause contusion at the chin may have more impact or the same as that that can lead to frank symphyseal fractures.

This study shows that predictably, condylar fractures in females may be seen more in patients with unilateral fractures and bilateral

fractures more in males. Condylar head injuries as observed from the study was positively associated with contusion and symphysis fracture. However, the statistical significance was more in symphysis fracture. It can be assumed that symphysis fracture has a higher probability of generating fracture at the condylar head. Symphysis fracture has a lot of impact that can transmit the force to the head of the condyle. Also, condylar neck fractures was observed more in females. Laceration, abrasion and male gender have negative association with condylar neck fractures.

Overall, in this study, contusion and symphyseal fractures showed positive association with condylar fractures in all the recorded types of condylar fractures. The significant impact of contusion was brought to the fore. This shows that contusion injuries has a lot of impact and so clinicians should watch out for concomitant condylar fractures in any observed contusion and other related injuries at the symphysis.

Condylar fractures caused by a symphyseal impact should be the same on both sides. However, in clinical practice, the patterns vary between the left and right sides because the factors that result in the fractures are complex and include the direction, intensity, and location of the external force and the biomechanical properties of the mandible [29].

5. CONCLUSION

The occurrence of mandibular fractures is strongly correlated with age, sex, soft tissue injuries and hard tissue injuries at the symphysis. Overall, contusion gave more of unilateral fractures while fracture at the symphysis resulted in more of bilateral condylar fractures.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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