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PATTERN AND FREQUENCY OF CONDYLAR FRACTURES IN CHILDREN: A CROSS-SECTIONAL STUDY AT KHYBER COLLEGE OF DENTISTRY, PESHAWAR

Sufyan Ammar Khan[1], Haseeba Younas[2], Atta ur Rehman[3]

1. Post graduate trainee, Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar, Pakistan.
2. Post graduate trainee, Department of Periodontology, Khyber College of Dentistry, Peshawar, Pakistan
3. Professor, Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar, Pakistan.

Corresponding author: sufikh96@gmail.com

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ABSTRACT

BACKGROUND: UCondylar fractures are among the most common mandibular fractures, accounting for a high proportion of injuries found in facial trauma cases. Their management is particularly challenging considering the variety of changes in the mandible as a child grows and the long term functional and aesthetic complications associated with it.

OBJECTIVE: To assess the frequency and pattern of condylar fractures in children presenting with mandibular trauma to S1 OPD in Khyber College of Dentistry.

METHODOLOGY: Data was collected on patients from birth to 18 years of age diagnosed with condylar fracture. Data was collected using a structured proforma including patient demographics and pattern of the fracture. Descriptive and inferential statistics were applied to analyze the association between demographics and pattern of fracture.

RESULTS: Among 118 patients of mandibular trauma, approximately 51% of mandibular fractures involved the condyle, majority of those being extracapsular fractures. There was a higher percentage seen in males at a ratio of 3.4:1. Fractures were more common in the age group of 4-7 years, being a total of 33 patients. Majority of fractures were unilateral and about 28.3% of the cases presented with displacement of the condyle and about 6.7% of the cases presented with total dislocation from the joint.

CONCLUSION: The most common level of condylar fractures was extracapsular, followed by subcondylar. Male predominance was shown in frequency of fractures and pre-school age (4-7 years) showed a higher frequency of condylar fractures in the mandible.

KEYWORDS: Condylar fracture, Mandibular fracture, Pediatric trauma, Frequency, Pattern, Maxillofacial injury.

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INTRODUCTION

Facial fractures in children are rare, showing about 1-15%, a lower incidence compared to adults. The reason for that includes factors like greater flexibility of bones, underdeveloped sinuses, unerupted teeth, the presence of a protective fat pad and less engagement in high velocity motor vehicle accidents[1]. The protected environment under supervision of parents also discourages cause of major injuries to the child[2].However, mandibular fractures are still most common facial fracture accounting for about 20-50% of these fractures[1]. In Posnick et al, 39% of all fractures in children were of the mandible, with sites including condylar (55%), parasymphysis (27%), angle (8%) and body fractures (9%)[3]. According to Thoren et al, the mandible fractures in the condyle is about 28-60% in children, higher than adults (19-38%)[4]. Only 1% of fractures occur in toddlers and pre-school children, as the facial bones are relatively retruded as compared to the skull[5].

General knowledge about the pattern of condylar fractures and their distribution is still incomplete[6]. Impact on the mandible region tends to displace the condyle posterosuperiorly, putting force upon the base of the skull with the head of the condyle, leading to a variety of injuries ranging from capsular tear, hemarthrosis, condylar head and neck fractures[5].Condylar fractures may be sub classified based on anatomical fracture sites to extracapsular (condylar neck or subcondylar) or intracapsular (condylar head) and on the basis of the degree of displacement to undisplaced, displaced or dislocated[7], but only 5% of fractures were displaced in older children[4].Condylar head fractures and intracapsular fractures have been seen to be less common than low condylar neck fractures. As the child grows, the probability of condylar fracture occurring diminishes and that of other sites increase such as angle and body[8]. Bradley, on the other hand, reported that most condylar fractures in children are extra capsular at 78%[4].

Fractures in children are not as frequently discussed compared to adults. Literature also shows indefinite knowledge on condyle fractures particularly regarding pattern and frequency of these fractures. The rationale for this study is to assess the patterns of condylar fractures in children as well the frequency of these fractures and their initial cause. This will give us a better understanding of condylar fractures that have complications that affect children, such as ankylosis. As a result, there is reduced growth of the mandible which further leads to problems with their airway, facial aesthetics and daily functioning which have a great impact on growing children and their personality.

Prevention of these complications will save the child from many social problems which would require extensive procedures for their management. Secondly, local literature of this topic is limited, and this study will help further the research of these types of fractures in our local population.

METHODOLOGY:

The study is an observational cross-sectional study conducted on patients of mandibular fracture below the age of 18 years at the Oral and Maxillofacial Surgery Department, in Khyber College of Dentistry, Peshawar. A sample size of 118 was calculated using WHO sample size calculator by taking prevalence of 5% displaced condylar fracture among children[4], a comparatively more conservative literature-based estimate of displaced cases. In this study, a non-probability consecutive sampling technique was used for data collection. Given the low incidence of pediatric condylar fractures in our region, all eligible cases during the study period were included to maximize sample size. All patients that were between birth to the age of 18 years presenting to S1 OPD in our department with mandibular fractures were included in this study. Mandibular fractures were diagnosed by history and clinical examination of the patients as well as radiographs, including Orthopantomogram, which was done for all cases, and Posterior Anterior face with CT scan used in for cases involving the midface or that were ambiguous, to assess the mandible of each patient. Classifications were based on the AO Craniomaxillofacial Classification System(AOCMF)[9] reviewed by two different maxillofacial surgeons to ensure consistency. Certain patients were excluded from our study and their data was not included such as: **(i)** Patients with metabolic diseases that affects bone strength and density. **(ii)** Patients with any existing pathology in mandible. (e.g., cysts or any lesion). **(iii)** Pathological fractures. **(iv)** Fire Arm Injuries involving the mandible, due to their different injury mechanism and pattern of fracture. **(v)** Conditions with agenesis of the mandible, as these cases would show an underdeveloped or absent condyle which may affect results. Once the data collection was complete, it was analyzed using SPSS version 25. Mean and standard deviation was calculated for numerical variable age. Frequency and percentages were calculated for categorical values like gender, pattern, displacement, and dislocation. Normality of the data was checked with Shapiro-Wilk test. Condyle frequency and pattern were stratified among gender, displacement and dislocation to see effect modifiers by using chi square test, with Fischer Exact test used for smaller subgroups. P value ≤ 0.05 were considered significant. All the data was presented in the form of tables and charts.

Ethical approval for this study was obtained from the Research Review Board (RRB) of Khyber College of Dentistry, Peshawar, under Notification No. 36/RRB/KCD dated 16/06/2023, following review in the meeting held on 14/06/2023. The study was conducted in accordance with institutional ethical guidelines.

RESULTS

The study included 118 patients with fractures of the mandible who were below the age of 18 years. The average age was 10 ± 5.1 years. Of all mandibular fractures, condylar fractures occurred with a frequency of 50.8% and 49.2% of cases having fractures not involving the condyle. The gender distribution showed a significant male predominance with almost a 3.4:1 as compared to females as seen in Figure 1.

Table 1: Association of Variables with Prescence of Fracture

		Presence of Fracture		
		Absent	Present	p-value
Gender	Male	49	42	0.061
	Female	9	18	
Age Group	0-3 years	4	7	0.719
	4-7 years	14	19	
	8-11 years	13	14	
	12-15 years	10	8	
	16-18 years	17	12	

Figure 1 Gender Distribution of Condylar Fracture in Children

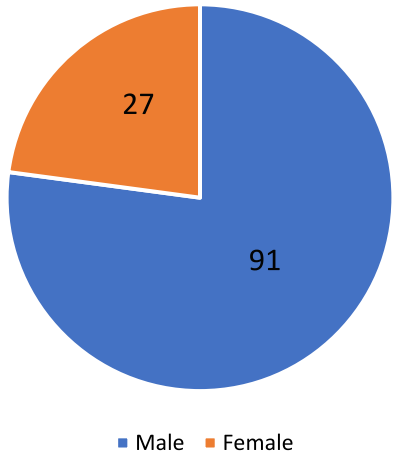


Table 2: Association of Variables with Gender

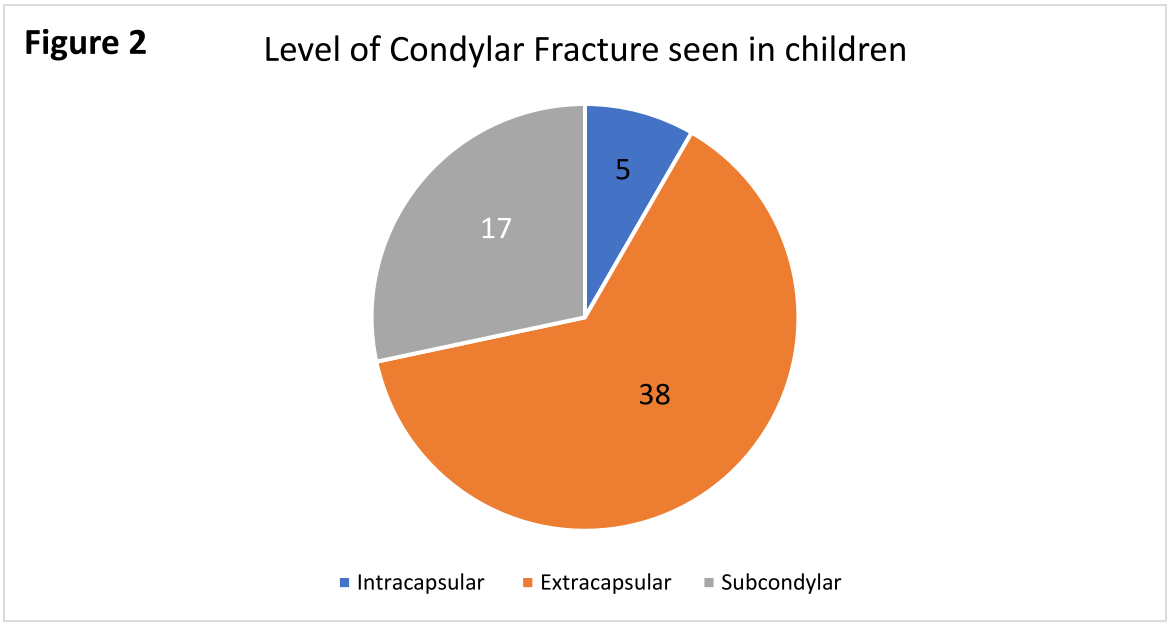
		Gender		
		Male	Female	p-value
Fracture Level	Intracapsular	2	3	0.076
	Extracapsular	25	13	
	Subcondylar	15	2	
Displacement	No Displacement	27	16	0.053
	Displacement	15	2	
Dislocation	No Dislocation	39	17	0.821
	Dislocation	3	1	

Fractures were found more common unilaterally (83.3%) than bilateral fractures (16.7%), with unilateral fractures showing almost an even distribution, having 56% of fractures on the left compared to 44% of fractures on the right. In terms of pattern, following the AOCMF classification[9], extracapsular showed to be the most common level of condylar fracture at 63.3%, followed by 28.3% at the subcondylar level and finally 8.3% the rarest at the intracapsular level at the condylar head (Figure 2). Amongst the cases of condylar fracture, 28.3% of the cases presented with displacement of the condyle and about 6.7% of the cases presented with total dislocation from the joint.

Table 3: Association of Variables with Pattern of Fracture

		Pattern		
		Unilateral	Bilateral	p-value
Fracture Level	Intracapsular	5	0	0.152
	Extracapsular	29	9	
	Subcondylar	16	1	
Displacement	No Displacement	38	5	0.096
	Displacement	12	5	
Dislocation	No Dislocation	48	8	0.064
	Dislocation	2	2	

Figure 2



In assessments regarding age of patients where fractures were more common, we divided them into age groups. We divided the data into 5 groups that balances clinical relevance considering features such as mandibular growth and development as well as the dentition; primary, mixed or permanent. The frequency of each of fractures in each of these age groups is shown in Figure 3, where the highest frequency observed is in the 4-7 years age group.

Figure 3: Frequency of Condylar Fracture in different Age Groups

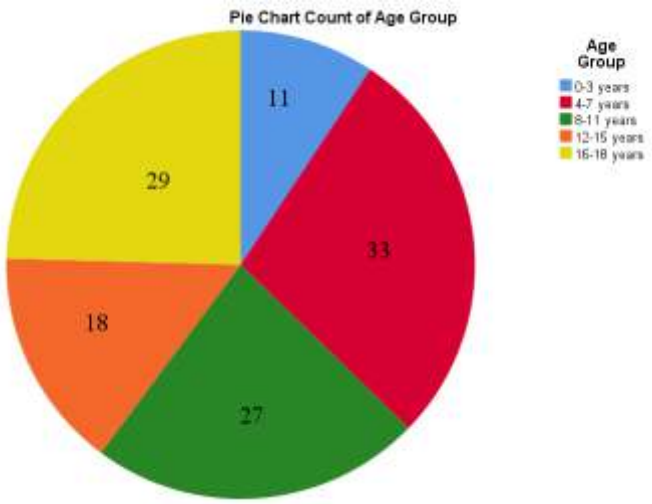


Table 4: Association of Variables with Age groups

		Age group					
		0-3 years	4-7 years	8-11 years	12-15 years	16-18 years	p-value
Fracture Level	Intracapsular	2	3	0	0	0	0.01
	Extracapsular	5	15	8	5	5	
	Subcondylar	0	1	6	3	7	
Displacement	No Displacement	7	16	7	4	9	0.116
	Displacement	0	3	7	4	3	
Dislocation	No Dislocation	7	19	13	7	10	0.166
	Dislocation	0	0	1	1	2	

The age variable's normality was assessed to determine the appropriate statistical tests. The Shapiro–Wilk test suggested that the data points significantly deviate from the normal distribution ($p < 0.001$). According to these results, the age variable was assumed not to be normally distributed, and, consequently, the non-parametric statistical methods were chosen. The mean age was 9.945 years and an Inter-Quartile Range of 10 years. Correlation of categorical variables (gender, fracture, level, pattern) were confirmed by the Chi square test and Fischer Exact test for smaller subgroups. Some associations may be underpowered due to smaller sample size. Due to exploratory nature, p-values are presented without adjustment for multiple testing.

The analysis showed that there was statistically significant association between the age group of the patients and the level of fracture seen in the condyle (p=0.01), as seen in Table 4. Gender of the patients did not show any statistically significance to neither level ($p = 0.076$) nor pattern of the fracture ($p = 0.709$), seen in Table 2. There was statistically significant association seen between condylar displacement of fracture and dislocation of these fractures ($p = 0.005$). Association of pattern of fracture with other variables can be seen in Table 3.

When the data was stratified by gender, significant association could be made for pattern and dislocation in females ($p = 0.014$). When considering the relationship between pattern and dislocation, a statistically significant association is made in regards to subcondylar fractures ($p = 0.005$) but no significance was established for extracapsular ($p = 0.368$). Finally, no statistically significant relationship can be made between displacement and dislocation when looking at extracapsular fractures ($p = 0.051$) nor in subcondylar fractures of the mandible ($p = 0.206$).

DISCUSSION

The study analyzed the pattern and frequency of condylar fractures among patients below the age of 18 years presenting with mandibular fractures. Condylar fractures represent one of the most common fractures of the mandible due to the anatomical and biochemical characteristics of the mandible. This can be seen in this study, with 50% of all fractures in the mandible presenting with condylar fracture, showing that the condyle remains still a highly vulnerable to high impact trauma. This is consistent with previous literature, which shows condylar fractures in about 25-50% of cases.[10]

A higher prevalence was observed in the age group of 4-7 years, likely due to this age group being increasingly active and mobile without fully developed co-ordination. Other research, such as a study done by Santanu Mukhopadhyay[11] shows a similar prevalence, with fractures most frequently noted in age groups of 6-9 years. The thinner condyle and elasticity of the mandible also increase the likelihood of fracture of the condyle as compared to the rest of the mandible. The craniofacial proportions seen in children also makes them prone to falling on their chin without much reflex to protect their face from injury.

This study showed that unilateral condylar fractures are much more common as compared to bilateral, which is similar to the results seen in Bottini GB et al.[12] and Kamal A et al.[13] showing a higher incidence of unilateral fractures. According to literature, bilateral fracture result from midline impacts, which are usually unlikely as most facial impacts are asymmetrical, also aided by the U shape of the mandible that allows it to twist slightly. Therefore, impact force lands on one side of the mandible leading to unilateral fracture.

A clear observation can be made that condylar fractures are much more common in males than in females. This can be seen in many other researches, with ratios as high 2:1 in Kamal et al.[13]and about 1.8:1 in Bottini et al.[14] These observed ratios reflect the sociocultural factors here, where male children more frequently engage in outdoor play and risk prone behavior.

Majority of studies show that displacement and dislocation are less common in children than in adults, which is also seen in this study, with displacement being more common of the two. This is likely due to the thicker periosteum which acts as a natural splint and elasticity of the bones in children and ligaments around the TMJ, hence can absorb more force to protect the condyle from displacing.

On statistical analysis, there was a statistically significant relationship between age and level of fracture, which is noted on our results as well showing that intracapsular fractures occur more frequently in much younger patients and tends to occur in extracapsular when they are older[15,16]. The low number of intracapsular fractures limits generalizability, but trends align with previous studies. Subcondylar fractures are relatively uncommon in children[17]. This may be due to changes in the mandible as a child grows. When they are very young, the neck is short and strong, in continuation with the ramus, while the head is cartilaginous and weaker, making it prone to fracture. As the child grows, ossification occurs and there is narrowing in the neck, hence the level of the fracture moving further down. However, the age of the patient showed no statistically significant relation, whether the fracture occurred unilaterally or bilaterally, or whether it was displaced or dislocated.

There was a statistically significant relationship between the displacement and dislocation of the condyle from the fossa. This is likely as fractures that usually are displaced have a significantly higher tendency to be dislocated as well.

When data was stratified by gender, a significant statistical association was made between pattern and dislocation in females, but not in males, yet there is limited and inconclusive evidence that would support this in current research, suggesting it may be a finding due to chance.

Analysis of pattern and dislocation showed a specific statistical association in regards to the subcondylar region, which was significant. A likely reason for this could be that on lower-level

fractures, the proximal segment (condylar head) is less constrained by the ramus and hence more mobile. As a result, the condyle is more likely, and often the case, to be pulled by the action of the lateral pterygoid muscle[18]. This makes the condyle dislocate anteriorly and/or medially, a mechanism preserving the integrity of the cranial base, which could have more severe consequences[19]. Other researches such as one done by Atiq ur Rehman et al.[20] show a higher incidence of displacement with subcondylar fractures, not specifying dislocations in their study, so there is no exact evidence for it. Other articles such as an article by Kazuya Yoshida[21] show results that dislocation is more frequent in condylar neck fractures.

The above data bear clinical significance, as awareness of the prevalence of condylar fractures in children is just as important, if not more than in adults and will help raise suspicion of clinicians to properly assess the condyles of younger patients for a fracture, take adequate imaging when required and intervene when necessary to help prevent long standing complications such as TMJ ankylosis, facial deformities, malocclusion and chronic pain. The identified relation of age and level of condylar fracture helps give us insight on what areas to focus and emphasize on for accurate diagnosis of each individual with possible condylar fracture.

CONCLUSION:

This paper presents epidemiological and anatomical distributions of mandibular fractures involving the condyle in patients in a tertiary care dental hospital. It was found that over 50% of mandibular cases involved the condyle of the mandible, majority in males at the age of 4-7 years at the extracapsular level. In clinical analysis of condylar fractures, accurate diagnosis and imaging in younger patients is very important. This will help avoid many of the possibly drastic complications if any fracture were missed with severe consequences. Despite limitations in sample size and design, this study provides local insights into pediatric condylar fractures.

The cross-sectional design, limited to a single center, does not allow broader generalization. There is a possible limitation due to the sample size (n = 118) for infrequent sites such as intracapsular fractures. Referral bias may have contributed to the fracture pattern and level distribution presented. Sampling bias is should be noted as only cases that reported to tertiary care were assessed and not milder cases. There are also statistical limitations with multiple subgroups analysis done without adjustments increases risk of false positives. Analysis of rare fracture types and smaller subgroups such as those with displacement and dislocation may have limited accuracy and generisability, showing underpowered results.

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Key Contributions of the Authors	
Author Names	**Author Contributions**
Sufyan Ammar Khan	A, B, C, D
Haseeba Younas	B, C, D
Atta ur Rehman	B, C, D

Key for Author Contributions:

A.Conception or Design
B.Acquisition, Analysis, or Interpretation of Data
C.Manuscript writing
D.Critical Review and approval

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved