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ORIGINAL ARTICLE

Frequency of temporomandibular joint ankylosis secondary to condylar fractures among patients presenting to Oral and Maxillofacial Department Ayub Teaching Hospital Abbottabad.

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ABSTRACT… Objective: Trauma, particularly condylar fractures, continues to be one of the most common etiological causes for TMJA. Condylar fractures if not treated well, they make patients prone to ankylosis by fibrosis followed by bony fusion. Early detection and proper management are, thus, essential for preventing ankylosis. **Study Design:** Prospective Observational study. **Setting:** Ayub Teaching Hospital, Abbottabad. **Period:** December 2024 to May 2025. **Methods:** We included 127 patients with clinically diagnosed condylar fractures by non-probability consecutive sampling. TMJ ankylosis was examined clinically with restricted or non-existent mandibular movements and firm end feel. Ankylosis and variables associated with the fracture were correlated with Fisher's exact test, with $p < 0.05$ regarded as statistically significant. **Results:** Traffic road accidents were the most common cause (59.1%). Intracapsular fractures were the most common (72.4%), and unilateral presentation was more common (56.7%). Limited mouth opening was the most common presenting feature (67.7%). TMJ ankylosis was present in 7.1% of the patients, which was more common in intracapsular fractures, bilateral presentations, and after traffic road accidents, although these trends were not statistically significant. There was a high correlation with duration of fracture ($p < 0.001$), as no ankylosis was seen in cases with presentation within ≤6 weeks, but the prevalence was 13.8% with presentation in 3–6 months and 38.5% after 6 months. **Conclusion:** Ankylosis of TMJ is a serious complication of delayed treatment of condylar fractures, the strongest predictor of which is the duration of fracture. Early treatment should be done to avoid ankylosis.

Key words: Condylar Fracture, Temporomandibular Joint, TMJ Ankylosis.

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INTRODUCTION

Temporomandibular joint ankylosis (TMJA) is a disabling disorder involving partial or total limitation of mandibular movement as a result of ankylosis of the condyle to the temporal bone.[1] It causes severe functional disabilities such as impaired mastication, speech difficulty, and oral hygiene impairment, in addition to disfiguring facial deformities and psychological impairment.[2] Trauma, particularly condylar fractures, continues to be one of the most common etiological causes for TMJA.[3] Condylar fractures account for almost 25–35% of all fractures of the mandible, and if not treated well, they make patients prone to ankylosis by fibrosis followed by bony fusion.[4] Early detection and proper management are, thus, essential for preventing ankylosis and its long-term effects on oral function and quality of life.[5]

Several studies have quantified the relationship between condylar fractures and the development of TMJ ankylosis. Xiang et al. assessed 385 patients with 492 surgically treated mandibular condylar fractures between 2001 and 2010 and found that ankylosis of the TMJ occurred in 16 patients, in 26 joints—an occurrence of roughly 5% at 6 months to 10 years of follow-up. Condylar head fractures were more prone to lead to ankylosis, 20 out of 248, while 6 out of 193 neck fractures were involved, with none seen in 51 subcondylar fractures.[6] Likewise, He et al. described 25 post-traumatic TMJA patients, which included 40 ankylosed joints, 62.5% of which were linked with intracapsular sagittal condylar fractures. In this series, 47.5% of the joints had lateral or superolateral displacement, 64% were untreated or inadequately treated anterior mandibular fractures, and 50% of the patients showed facial asymmetry

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or crossbites.[7] Anchlia et al. presented additional large-scale information from 386 patients with a total of 521 ankylosed joints and discovered 65% to be unilateral, with bony ankylosis being the most common in 73.9% of them. The mean preoperative maximal incisal opening was 5.4 mm, improving significantly to 36.9 mm after one year. Transient facial nerve paresis occurred in 14.8% of patients, while the recurrence rate of ankylosis was 8.8%.[8]

Despite the well-documented global burden of TMJA, there remains a lack of epidemiological data from Pakistan, particularly in northern populations. The majority of published studies have centered on surgical intervention or recurrence without much focus on its true incidence.[9,10] It is necessary to determine local data in order to enhance diagnostic vigilance, maximize management plans, and create preventive regimens appropriate to the local population. The objective of this research is to identify the prevalence of temporomandibular joint ankylosis secondary to condylar fractures among patients attending the Oral and Maxillofacial Department at Ayub Teaching Hospital, Abbottabad.

METHODS

This prospective observational study was conducted in the Department of Oral and Maxillofacial Surgery at Ayub teaching hospital, Abbottabad, from December 2024 to May 2025. Ethical approval was obtained from the institutional review board (APPROVAL CODE /REF.NO.RC-EA-2024/082). Sample size was calculated using a single-proportion formula with p=0.05 from Xiang et al.[6] and 95% confidence, precision d=0.04. The required sample was 115; allowing 10% attrition, the final target was 127.Written informed consent was taken from all participants prior to inclusion.

Inclusion Criteria

Both male and female patients aged 5–60 years who have a history of confirmed condylar fracture both clinically and radiographically, present between 6 months to 2 years after the trauma, and who have diagnostic imaging available (orthopantomogram/ CT).

Exclusion Criteria

Those patients with underlying temporomandibular joint (TMJ) ankylosis before trauma, with pathological fracture, systemic bone pathology, or insufficient records and lost to follow-up prior to evaluation.

Data were collected on a proforma. Demographic data were age (divided into 18–29 years, 30–39 years, 40–49 years, and 50–60 years) and gender (male, female). The nature of condylar fracture was noted as intracapsular or extracapsular on radiographic and clinical findings. Fracture duration was divided into ≤2 weeks, 2–6 weeks, 6 weeks–3 months, 3–6 months, and >6 months since injury. The cause of fracture was described as road traffic accident (RTA), fall, or assault. The side affected was categorized as unilateral or bilateral. The presenting complaint was noted as asymmetry with limitation of mouth opening and pain, limited mouth opening alone, pain with limited mouth opening, or asymmetry with limited mouth opening. Clinical examination was conducted to ascertain the existence or non-existence of temporomandibular joint (TMJ) ankylosis, the primary outcome measure. Ankylosis was diagnosed on the basis of limited mouth opening, history, and radiographic evidence.

Statistical significance of data was examined with statistical package for social sciences (SPSS) version 23. Percentage and frequency were determined for categorical variables. Fisher's Exact Test was used to find out association between TMJ ankylosis and investigated categorical variables, taking a p-value ≤0.05 as statistically significant.

RESULTS

A total of 127 condylar fracture patients were enrolled, the majority between 30–49 years, with males accounting for almost two-thirds of the sample. As far as fracture duration was concerned, one-third of patients presented within ≤2 weeks (33.1%) or 2–6 weeks (33.1%), while 22.8% were between 3–6 months and 10.2% after >6 months. Intracapsular fractures were the most common (72.4%), and road traffic accidents were the most frequent cause (59.1%). Unilateral presentation was slightly more frequent than bilateral (56.7% vs. 43.3%). Restricted opening of the mouth was the most common presenting symptom (67.7%) as seen in Table-I. Ankylosis of the TMJ occurred in 7.1% of cases, more frequently after intracapsular fractures,

after RTAs, and in bilateral presentations, though these were not statistically significant. Fracture duration was highly correlated with ankylosis ($p < 0.001$) with no occurrences seen in those presenting within ≤6 weeks, whereas prevalence became 13.8% in patients with 3–6 months duration and 38.5% in those with >6 months duration. Limited mouth opening was also reported more often in ankylosis patients, but no clinical variable had a significant relationship with its occurrence (Table-II).

TABLE-I

Baseline characteristics of patients with condylar fractures (n = 127).

Variables	Categories	n (%)
Age	18-29	32 (25.20%)
	30-39	35 (27.56%)
	40-40	38 (29.92%)
	50-60	22 (17.32%)
Gender	Male	82 (64.57%)
	Female	45 (35.43%)
Type of condylar fracture	Intracapsular	92 (72.44%)
	Extracapsular	35 (27.56%)
Duration of condylar fracture	≤ 2 weeks	42 (33.07%)
	2-6 weeks	42 (33.07%)
	6 weeks-3 months	1 (0.79%)
	3-6 months	29 (22.83%)
	>6 months	13 (10.24%)
Cause of fracture	RTA	75 (59.06%)
	Fall	37 (29.13%)
	Assault	14 (11.02%)
Side involved	Unilateral	72 (56.69%)
	Bilateral	55 (43.31%)
Main complaint	Assymetry/ mouthopening/pain	24 (18.89%)
	Mouth opening	86 (67.72%)
	Pain/mouthopening	9 (7.09%)
	Assymetry/mouth opening	8 (6.30%)

DISCUSSION

In our study of 127 patients with condylar fractures, TMJ ankylosis was observed in a small proportion (7.1%). Importantly, the longer the duration between fracture and evaluation, particularly beyond three months, the higher the risk of ankylosis, reaching up to 38.5% in fractures older than six months. Other variables such as fracture type, cause, laterality, and primary complaint showed no statistically significant associations.

In comparison with other studies, the overall low prevalence is consistent with previous reports. Our findings are also consistent with Anyanechi who found that fractures complicated by ankylosis were intracapsular (n=22/56, 39.3%) and extracapsular (n=34/56, 60.7%). Ankylosis rose progressively with the rise in time lag between injury and fracture management (p=0.001). All of the ankylosis cases were unilateral[11], but in the current research the occurrence of ankylosis was found mostly on bilateral side (10.91%). The supremacy of trauma as a causative factor in ankylosis is amply testified. Mekonnen et al. examined 95 TMJ ankylosis cases over nine years at St. Paul's Hospital in Ethiopia and observed that trauma represented 77.9% of cases[12], closely paralleling our findings and affirming the pivotal position of traumatic condylar injury. CBCT-based studies also depict the radiographic heterogeneity and severity of ankylosis. Imanimoghaddam et al. analyzed 32 ankylosed TMJs and stressed that sophisticated imaging is priceless in precise classification and preoperative planning, but they did not provide incidence quantitation.[13]In comparison, in systemic inflammatory diseases like ankylosing spondylitis (AS) patients, temporomandibular joint disorders (TMDs) are significantly more common.

Souza et al. reported that 57% of 30 AS patients exhibited TMDs in all three diagnostic categories (RDC/TMD Groups I–III) and 30% of them qualified for two categories.[14] While their research did not emphasize ankylosis per se, these high rates of TMJ in AS present dramatically in contrast to your modest 7.1% ankylosis in your trauma cohort—high-lighting that systemic musculoskeletal disease encompasses a much larger burden of TMJ pathology. Upadya et al. in their systematic review of TMJ ankylosis classifications and surgical interventions, confirm that trauma—most notably condylar fracture—is the most frequent cause, particularly if diagnosis or treatment is delayed or confounded by infection or improper management.[15]

TABLE-II

Association of clinical variables with presence of temporomandibular joint ankylosis (n = 127).

Variables		Presence of TMJ Ankylosis		P- Value
		Yes n (%)	No n (%)	
Type of condylar fracture	Intracapsular	8 (8.69%)	84 (91.30%)	0.443
	Extracapsular	1 (2.86%)	34 (97.14%)	
Duration of condylar fracture	≤ 2 weeks	0 (0%)	42 (100%)	<0.001
	2-6 weeks	0 (0%)	42 (100%)	
	6 weeks-3 months	0 (0%)	1 (100%)	
	3-6 months	4 (13.79%)	25 (86.21%)	
	>6 months	5 (38.46%)	8 (61.54%)	
Cause of fracture	RTA	7 (9.33%)	68 (90.67%)	0.676
	Fall	2 (5.26%)	36 (94.74%)	
	Assault	0 (0%)	14 (100%)	
Side involved	Unilateral	3 (7.14%)	69 (95.83%)	0.174
	Bilateral	6 (10.91%)	49 (89.09%)	
Main complaint	Assymetry/mouthopening/ pain	1 (4.17%)	23 (95.83%)	0.916
	Mouth opening	8 (9.30%)	78 (90.69%)	
	Pain/mouthopening	0 (0%)	9 (100%)	
	Assymetry/mouth opening	0 (0%)	8 (100%)	

Their insistence on the paramount role of early diagnosis and classification reproduces our results, wherein fracture duration was the best predictor of ankylosis development.

In the children, Rozanski et al. reviewed 176 surgically treated TMJ ankylosis patients and had a 2.27% re-ankylosis rate in a mean follow-up of about 28 months. Although their research did not address outcomes after surgery but instead outcomes in terms of fracture-to-ankylosis incidence, it highlights the importance of age and early treatment in determining outcomes.[16] Our observation of rising ankylosis rates with delayed presentation aligns with their broader conclusion that children, with still-developing joints, are particularly vulnerable when timely treatment is not administered.

The low incidence of TMJ ankylosis is compared to that of Huang et al. who reported that AS patients were 2.66-fold more likely to have temporomandibular disorder (TMD) than matched controls (adjusted HR: 2.66; 95% CI: 1.79–3.97; $P < 0.0001$).[17] This indicates that systemic illness places a much higher risk of developing TMJ pathology compared to post-traumatic complications in otherwise well individuals. Ahısha&Kesiktaş found that 57% of AS patients qualified for TMD in all three diagnostic groups (RDC/TMD), which shows great prevalence of TMJ involvement among them.[18] And as their study lacked a healthy control comparison as well as pandemic specific reference, more context is required before direct comparisons are made. Nevertheless, it also demonstrates that systemic inflammatory causes are linked to many more rates of TMJ pathology than single trauma. Ramly and co-workers studied TMJ ankylosis in children with craniofacial discrepancies, finding 44 ankylosed joints in 28 patients (mean age at time of surgery ≈3.7 years) with a mean follow-up period of 13.7 years.[19] Most importantly, they described a high rate of recurrence at 75%, where most children had undergone multiple procedures and some underwent tracheostomy or gastrostomy because of the severity of the condition. Even though these are definitive ankylosis cases—differing from our trauma group, they confirm that once ankylosis has occurred, especially in the young and syndromic population, the condition recurs and carries high morbidity. Mubashir et al. compared imaging

results in traumatic and infectious etiology TMJ ankylosis using CBCT. Post-traumatic ankylosis, while uncommon, is generally more structurally well-defined and radiographically evident.[20] Our clinical observations of considerably higher risk of ankylosis with a delay in presentation harmonize with such imaging-based observations, vindicating early treatment to avoid well demarcated bony union. Observation of trauma by Rahman & Haider as a leading cause and the complex ankylosis types in late presentations supports our results in highlighting the significance of early detection and treatment—especially in pediatric patients with greater osteogenic potential and risk of fusion.[21]

LIMITATIONS

There are a few limitations in this study that need to be recognized. Firstly, the sample size, whilst adequate to illustrate trends, was comparatively small and confined to one-center cohort, and this may limit the generalizability of the outcome to large and diverse populations. Secondly, the retrospective design carries a risk of incomplete records and recall bias in defining the precise interval between condylar fracture and onset of ankylosis. Third, radiographic assessments were based on imaging quality and availability, which could have resulted in slight inaccuracies in describing the type and stage of ankylosis. Lastly, while several variables including etiology, age, and duration of fracture were taken into account, possible confounders such as socioeconomic status, healthcare access, and treatment adherence were not completely controlled, which could have affected the results.

CONCLUSION

In spite of these constraints, the research presents useful information regarding the correlation between untreated condylar fracture duration and temporomandibular joint ankylosis prevalence. The findings indicate that long periods between fracture incidence and clinical presentation are significantly associated with increased risk of ankylosis.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Jannat ul Mawa:** Conception of research, data collection.
2	**Khurshid Alam:** Write-up.
3	**Ammara Saleem:** Data collection.
4	**Bakhtawar Aziz:** Data entry.
5	**Zainab Mushtaq:** Critical review.
6	**Muhammad Ifham Khan Jadoon:** Data analysis.