RESEARCH PAPER

Pre-Treatment Evaluation of Condylar Fractures: A Detailed Review

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ABSTRACT

Background: Condylar fractures of the mandible are among the most common maxillofacial injuries, accounting for a significant proportion of mandibular fractures. These fractures typically result from indirect trauma, where force applied to the mandible is transmitted to the condylar region. The anatomical vulnerability of the condylar neck makes it particularly susceptible to injury.

Aim: In this study, data collection was done and analyzed using PRISMA flow chart. Total of 20 articles were included for the study based on inclusion and exclusion criteria. Quality assessment was done by RoB 2 second version of Cochrane's risk of bias tool.

Results: The results of the systematic review indicate that various mechanisms, including direct impact, falls, and road traffic accidents, contribute to the occurrence of condyle fractures, often influenced by biomechanical factors such as force direction and magnitude. Multiple classification systems have been proposed based on fracture location, displacement, and dislocation. Clinically, condylar fractures present with pain, swelling in the preauricular region, restricted mandibular movement, malocclusion, and deviation of the jaw, with distinct features in unilateral and bilateral cases.

Conclusion: Diagnosis relies on clinical examination supported by imaging modalities such as orthopantomogram (OPG), Towne's view radiographs, CT scans, and MRI for soft tissue assessment. Understanding the classification, clinical features, and appropriate investigative approaches is essential for accurate diagnosis and effective management of condylar fractures.

Keywords: Biomechanical factors, Hunting bow concept, mechanism of injury, unilateral and bilateral condyle fractures, Radiographic assessment

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INTRODUCTION

In the eighteenth century, a French surgeon reported a high risk to fracture for narrowed segment in the subcondylar region

Fractures of the mandibular condyle represent one of the most common injuries of the facial skeleton, accounting for approximately 25–40% of all mandibular fractures. Owing to the anatomical position of the condyle and its functional role in the temporomandibular joint (TMJ), condylar fractures have significant implications for mastication, speech, occlusion, and overall mandibular growth and development. The condylar process acts as a key growth center of the mandible and plays a pivotal role in maintaining facial symmetry and vertical ramus height.

The mandible is the only mobile bone of the facial skeleton and transmits traumatic forces along its arch. Indirect trauma to the chin frequently results in fracture

of the condylar neck or head due to force transmission posteriorly along the mandibular body. Condylar fractures may occur unilaterally or bilaterally and are commonly associated with other mandibular fractures, particularly those of the symphysis and parasymphysis regions.

Anatomically, the condylar process consists of the condylar head, neck, and subcondylar region. Based on the level and displacement, fractures are commonly classified into intracapsular (condylar head), extracapsular (neck), and subcondylar fractures. Various classification systems have been proposed, including those described by Lindahl and later modifications incorporated into contemporary maxillofacial trauma guidelines. Accurate classification is essential for determining appropriate management strategies and predicting functional outcomes.[1]

I. ANATOMY:

Condyle:

The condyle- knuckle like structure a strong upward projection from the postero-superior part of the ramus. Backward angulation of 15–33° to frontal plane. (Fig 1)Angulation of 145–160° between anterior ligament of foramen magnum on basion. The condylar head is ovoid in shape and measures 15–20 mmmediolaterally and 8–10 mm anteroposteriorly respectively. (Fig 2)

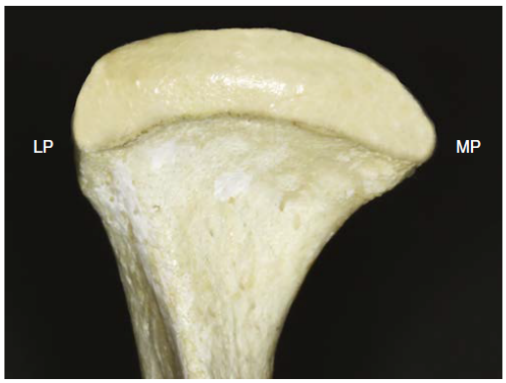

Fig 1: The Condyle (Anterior view) showing medial pole (MP) and lateral pole (LP) [2]

Fig 2: This image shows the relation of condyle with base of skull [3]

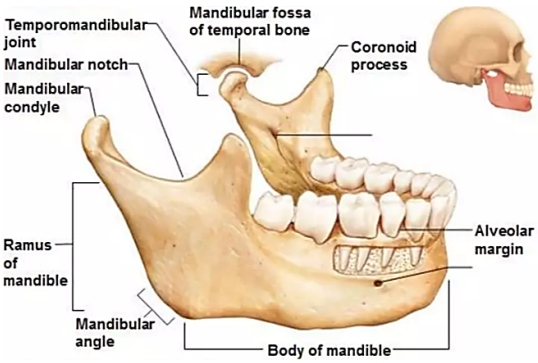

Fig 3: This image illustrates the location of condyle in relation to cranial vault

Bluntly pointed lateral pole and rounded medial pole. Articulates with the glenoid fossa in the squamous portion of the temporal bone to form the temporomandibular joint. Squamous portion of temporal bone is as thin as 2 mm, condylar processes may displace into the middle cranial fossa following trauma.

ANATOMY OF ADULT vs PEDIATRIC CONDYLE

The anatomy of adult vs pediatricage group varies widely. As children grow, their **craniomaxillofacial (CMF) structures** undergo significant developmental changes, which influence the **site, pattern, and characteristics of CMF injuries.** (Table 1)

The **condylar structure and anatomy** in children are also different from those in adults, making the **management of paediatric condylar fractures** considerably distinct from that of adult condylar fractures[4]

ANATOMIC STRUCTURE	CHILD	ADULT
Cortical bone	Thin	Thick
Condylar neck	Broad	Narrow
Articular surface	Thick	Thin
Capsule	Highly vascular	Less vascular

Table 1: Anatomy of Adult vs child[5]

III.Hunting Bow Concept

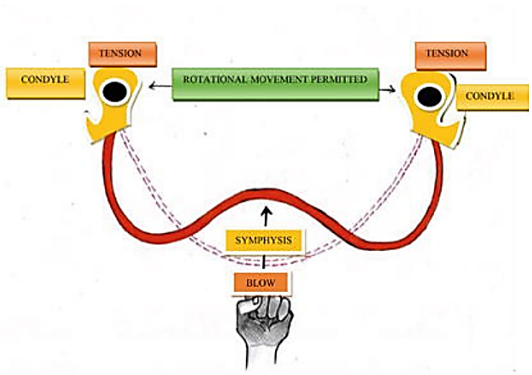

Fig 4: Mechanism of condyle fracture as an indirect injury due to direct hit on symphysis[6]

Any blow to the midline of the mandible can cause bilateral condylar fracture and any blow to the parasymphysis may cause a contralateral fracture (contrecoup injury)- Parade ground/Guardsman fracture (Fig 5)

IV. MECHANISM OF INJURY

According to Lindahl mechanism of injury is of following:

Lindahl(1977):

Kinetic energy imparted by a moving object through the tissues of a static individual. This commonly results from trauma sustained from a fist during sporting activities, or in the course of some industrial accidents.

Lindahl(1977):

Kinetic energy derived from the movement of the individual and expended upon a static object. This is exemplified by a fall during an epileptic fit, or following a faint when the patient is unable to protect the face with an outstretched hand as in the case of the so-called 'parade- ground' fracture

Lindahl(1977):

Kinetic energy which is a summation of forces derived from a combination of (1) and (2) and, therefore, generally produces a more severe type of injury such as typically occurs ina road traffic. accident.[7]

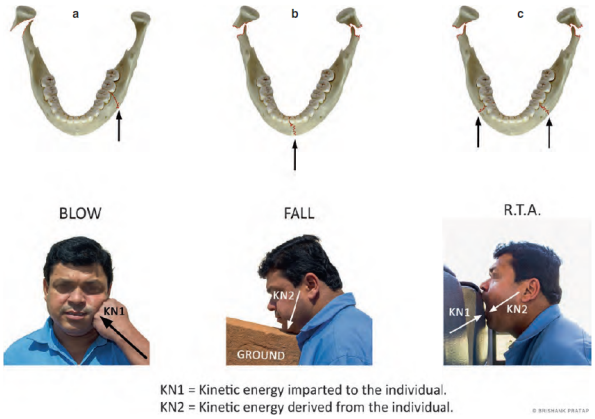

Fig 5:Mechanism of injury for unilateral and bilateral condyle fracture

V. CLASSIFICATION OF CONDYLE FRACTURES

Wassmund 1927

Based onComminuted head fractures and Chip fractures. Condylar neck fracturescan be classified as Vertical neck fracturesecondary to shearing, Transverse neck fractures secondary to bending and Oblique neck fractures caused by a combination/bending

Wassmund 1934

Based on dislocated fractures of the condyle, he classified asType I : bony contact between the fractured fragments with 10–40° angulation of the condylar head.Type II: bony contact between the fractured fragments with 50–90° angulation of the condylar head.Type III: no bony contact with severe medial displacement [9]

Lindahl 1977

Based on fracture location, deviation, and/or displacement, position of condylar head in articulating fossa[10]classified as Sub condylar fracture where fracture line extends from sigmoid notch to posterior border of the mandible, Condylar neck fracture where fracture located below level of condylar head at the condylar process and Condylar head fracture where fracture enclosed by the capsule of the temporomandibular joint

Based on Fracture levelit is divided into Condylar head, Condylar neck and Sub condylar/condylar base fracture

Based on Deviation and displacementit is classified asmedial overlapping with bending or deviation, lateral overlapping with bending or deviation ,no overlapping

with bending or displacement and no deviation or displacement

Based on Relation between condylar head and fossait is classified asabsence of dislocation, mild ,moderate and Complete or severe dislocation

Based on Condylar head fractureit is classified as Horizontal fracture, vertical fracture and Compression fracture

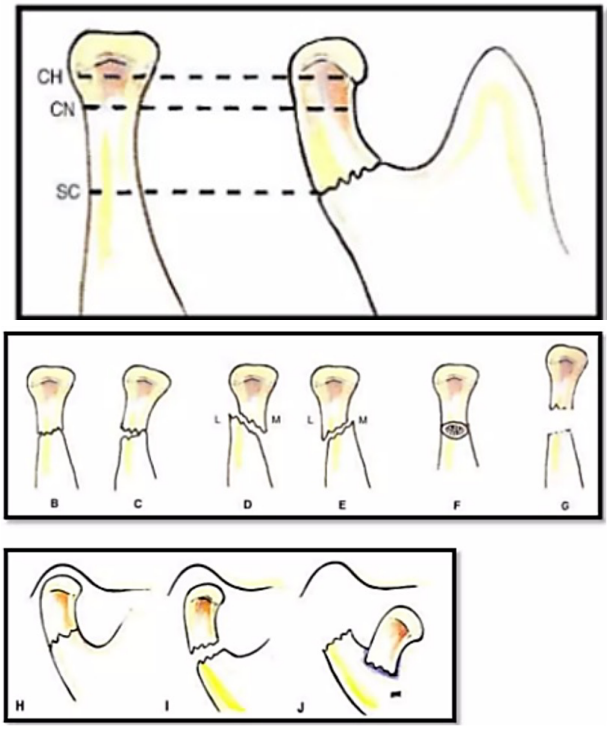

Fig 6:Lindahl classification of condylar fractures[10]

The AO 2010

AO classified condylar fracture as Line 1 which runs parallels the posterior border of the mandible**. Line 2, the** sigmoid notch line runs perpendicular to line 1 at the deepest portion the sigmoid notch.**Line 3,** is perpendicular to the first line and is below the lateral pole of condylar head

.A line is drawn half way between the lateral pole line and the sigmoid notch line.A "high-neck" fracture is above this line, a "low-neck" fracture is below[11]

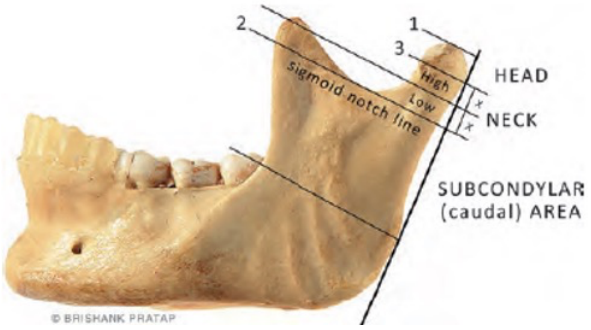

Fig 8:AO 2010 classification[12]

MacLennan Basedon simple bending, displacement, and dislocation fractures of condylar process can be divided into Class I whereno deviation (bending) is evident.Class IIwhere deviation (bending) at the fracture level is evident.Class III where displacement (condylar head remains within fossa) is evident

Class IV: dislocation (condylar head outside of fossa)[13]

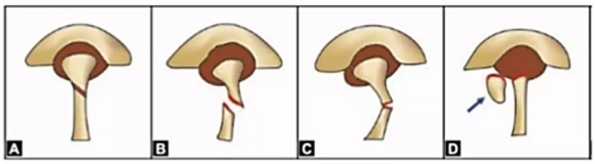

Fig 9: MacLennan classification

Spiessl and Schroll Based on fractures of the base and neck of the condyle,

the range of angulation with deviation, displacement, or dislocation[14]

Type I: condylar neck fracture with no associated deviation/displacement

Type II: low condylar neck fracture with deviation/displacement

Type III: high condylar neck fracture with deviation/displacement ventralmedial lateraldorsal

Type IV: low condylar neck fracture with dislocation

Type V: high condylar neck fracture with dislocation

Type VI: intracapsular fracture of the condylar head

Loukota 2005

This Classification described "Line A," which is a perpendicular line that extends from the deepest part of the coronoid notch to the posterior border of mandibular ramus.

Diacapitular fracture: Starting in the articular surface thefracture line may extend outside the TMJ capsule

Condylar neck: Major portion of the fracture line whichstarts above the line A remains above it

Condylar base: Major portion of the fracture line remainsbelow the line A, and it extends behind the mandibularforamen

Minimal displacement: Less than 100 displacement or2 mm overlap of the bone edges or both.[15]

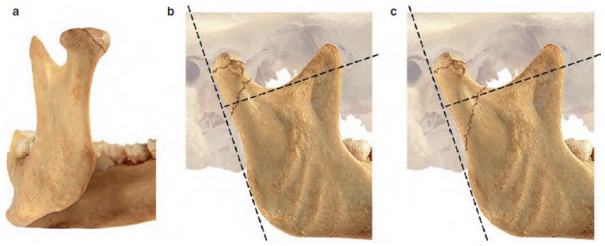

Fig 11: Loukataclassification : (a)Anatomic Condyle(b) Condylar neck fracture (c) Condylar base fracture

CLINICAL EXAMINATION:

The history of the patient should include the following questionnaire

How did the patient sustain the injury?,Area of impact, Direction of impact, Degree of force

UNILATERAL CONDYLAR FRACTURE

On inspection

The following features are to be noted for inspection in case of unilateral condylar fracture which includespain and swelling over preauricular region,Temporal bone may be accompanied by cerebrospinal fluid leak which is termed as otorrhea, hematoma surrounding the fractured condyle, ecchymosis in the mastoid region (Battle's sign),hollowness over the condylar region, ear bleed will persist if the head of the condyle is impacted in the glenoid fossa. deviation of mandible toward the side of fracture, restricted incisal opening,locked mandibleand decreased range of movements. [16]

On palpation

The following physical examination have to be elicited in case of unilateral condylar fracture which includespalpation of the condyle by standing in front of the patient. The little fingers are placed inside the external auditory canal and the patient is asked to open and close their mouth, by this method the position and movement of the condyles are determined. (b)Tenderness over the condylar area (c)Displacement of the condylar head within the external auditory meatus.(d)Paresthesia of the lips may be present as hemorrhage from the condylar region crosses the base of skull and exerts pressure on the mandibular division of the trigeminal nerve as it emerges from the foramen ovale.[17]

Unilateral condylar fracture: INTRA-ORAL EXAMINATION

The following features are to be elicited during intra oral examination which includes (Premature occlusion in ipsilateral side, open bite -loss of vertical height on contralateral side.affected side deviates on opening and is common becauseof the interruption of the action of the lateral pterygoidmuscle.gagging of occlusion on ipsilateral side due to telescoping of fracture fragments on the contralateral side due to contraction of the masseter, temporalis and medial pterygoid and upward pull of the ramal segment

Bilateral condylar fracture:

The following features are to be elicited during bilateral condylar fracture which includes Overall mandibular movements and mouth opening are restricted,If the condyle is displaced bilaterally, shortening of ramus occurs resulting in derangement of occlusion,overriding of the fractured segments result in anterior open bite, bilateral vertical loss of height with posterior gagging,associated fracture of symphysis or para-symphysis can also be present thus careful examination is mandatory (Contre-coupe fracture)[18]

RADIOGRAPHIC ASSESSMENT

Routine radiological investigations that aids in the diagnosis of condylar fracture areOPG,Towne's view,Posteroanterior skull projection or Reverse Towne'sview ,Computed Tomography, MRI, TMJ tomogram[19]

Others views areAP mandible coronal position, Oblique-lateral X-ray, Waters projection or Para nasal sinus view, Clementschitsch view or occipital, Nasal projection

Articular soft tissue injuries were Classified as(Grade I)hemarthrosis only, (Grade II)hemarthrosis and disc displacement, (Grade III)hemarthrosis, disc displacement and capsular tear, (Grade IV)disc perforation in association with Grade I,II or III.[20]

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