

Coronal Plane Articular Shear Fractures of Distal Humerus: Surgical Technique and Functional Outcome

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Abstract

Background: The objective is to outline the surgical technique pertaining to different fracture patterns and their outcomes. **Material and Methods:** A total of 7 patients with capitellum or trochlea or both were enrolled in the study. All patients were subjected to relevant investigations after which were taken up for surgical fixation with headless compression screw and if associated with posterior column involvement distal humerus plates were used. Depending on the fracture classified by dubberly et al surgical approaches either lateral kocher's approach or posterior approach with olecranon osteotomy is used. **Results:** A total of 7 patients coronal shear fracture of distal humerus underwent surgery. The outcome is assessed using Mayo Elbow Performance Score[MEPS]. Cases were followed up for 12 to 24 months (avg. 18 months). Postoperative Flexion-Extension Arc, Forearm rotation Arc and MEPS score are 135 ± 10 , 169.2 ± 8.2 and 85 ± 10 . Average Time of union is 9 ± 2 weeks. For Type 1 fractures union time was 7-8 weeks, for Type 2 & 3 fractures union time was 9-11 weeks. **Conclusion:** Utilising a lateral approach Headless compression screws can be used to treat capitellum and trochlea fractures, with satisfactory functional outcomes. Posterior approach using olecranon osteotomy can be used for type 3b fracture patterns.

Keywords: Capitellum, trochlea, distal humerus, coronal shear fractures, headless compression screws.

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INTRODUCTION

Coronal shear fractures of the distal humerus involving the capitellum, trochlea, or both are difficult fractures to treat due to their size, location, and articular nature. These fractures are a result of direct compression from the radial head in a semi flexed or hyperextended elbow or from spontaneous reduction of a posterolateral subluxation or dislocation.⁽¹⁾ Displaced capitellar and trochlear fractures invariably lead to poor clinical outcomes if left untreated⁽²⁾. The bone pieces may connect with the anterior humerus and typically displace superiorly. Because of the obstruction of the radial and/or coronoid fossa, this may result in a mechanical block to elbow flexion. Coronal shear fractures involving the articular surface, if they are associated with posterior comminution, can result in a poorer outcome because achieving anatomical and stable fixation is difficult. Possible sequelae include stiffness, pain, avascular necrosis, and post-traumatic arthritis. Despite the limited soft-tissue attachments of the fracture fragments, osteonecrosis has rarely been observed in prior studies⁽³⁾. The aim of this article is to outline the surgical technique pertaining to different fracture patterns and their outcomes.

MATERIALS AND METHODS

2.1 Participants

This is a prospective study involving 7 patients at tertiary health care centre. Fracture patterns are classified according to The Dubberley's classification. More recently, Dubberley

et al. described a classification based on 28 patients who underwent internal fixation. This system is of particular value, as it incorporates information on the fracture's anatomic pattern, the number of fragments and the extent of posterior comminution, all of which affect surgical decision making and provide prognostic value based on their series of patients. 1 Type 1 fractures involve the capitellum, with or without the lateral trochlea ridge; Type 2 involves the capitellum in continuity with more extensive extension into the trochlea and Type 3 describes separate capitellar and trochlea fragments. Each type is further divided into subtype A (no posterior comminution) and subtype B (posterior comminution)⁽⁴⁾.

Inclusion Criteria

- All age group with capitellum and trochlea fractures

Exclusion Criteria

- Elbow instability
- Ligamentous injury

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- Previous history to elbow
- Previous history of any surgery to the elbow

Radiological Assesment: Standard views for elbow are the antero-posterior and the lateral radiographs. Single arc in the lateral view it probably suggests a capitellum fracture. A Double arc sign represents the subchondral bone of the capitellum and lateral trochlear ridge.

To plan the surgical management 3D CT scanning is very much essential. 3D CT scan helps to know the exact extent of capitellum or trochlear fracture or involving both, it helps to whether there is any comminution or whether there is involvement of the posterior part.

Surgical technique: Following anaesthesia induction, patients were positioned either in supine position or lateral decubitus position depending on the fracture pattern. Surgical standards for skin preparation and draping were followed.

1. Lateral Kocher's approach: Used for type1,type2 and type3 fractures without posterior column involvement according to The Duberley's classification [Figure 1].
2. Posterior approach: used fractures involving the posterior column. The approach involves olecranon osteotomy [Figure 2]



Figure 1: shows lateral Kocher's approach

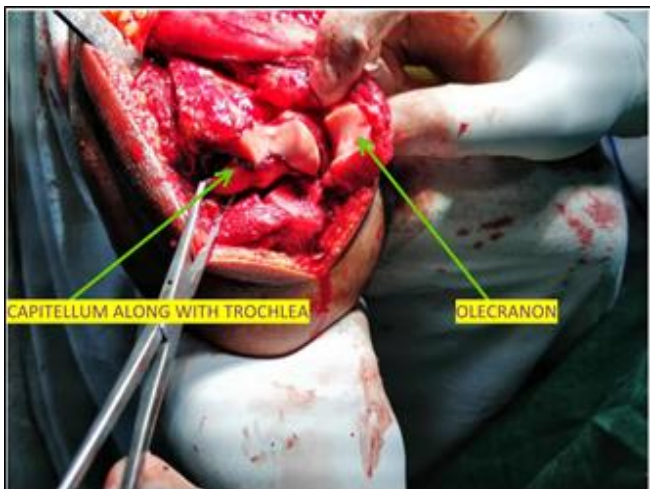


Figure 2: shows posterior approach with olecranon osteotomy

Fixation: In our study, according to Dubberly's classification there were 3 type1A and 2 type2A fractures. These cases since they didn't have posterior involvement were approached by lateral Kocher's approach. On reaching the fracture site fragments were reduced temporarily with k wire and depending upon the fragment size headless compression screws of size 3.5 or 2.7mm are inserted in the AP direction. The head is counter sunk into the bone so that it doesn't interfere with the articulation of the elbow joint. [Figure 3].

2 cases were according to type3B Dubberly's classification. Since these patients have posterior column involvement posterior approach using olecranon osteotomy was performed. After holding the fractures in reduction precontoured plates are placed and capitellum and trochlear fragments were fixed using headless compression screw [Figure 4].

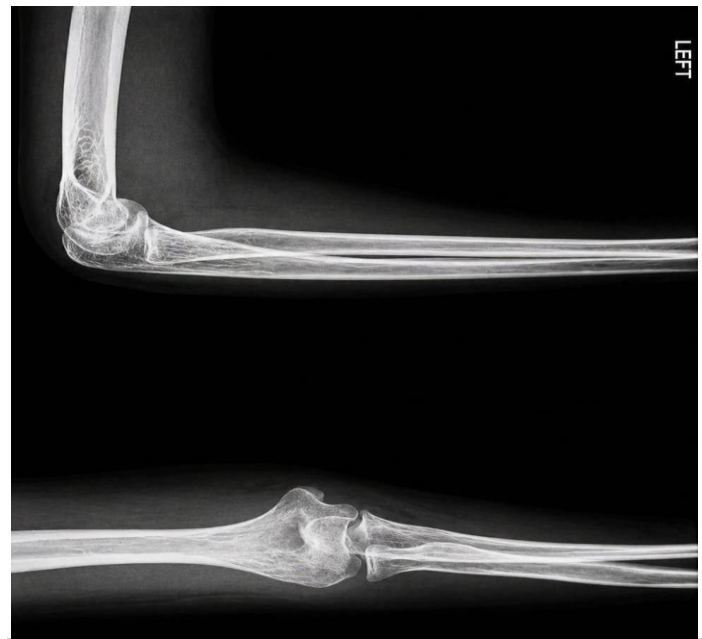


Figure 3A: shows type2 fracture as per Dubberly's classification



Figure 3B: shows type2 fracture treated with headless compression screws

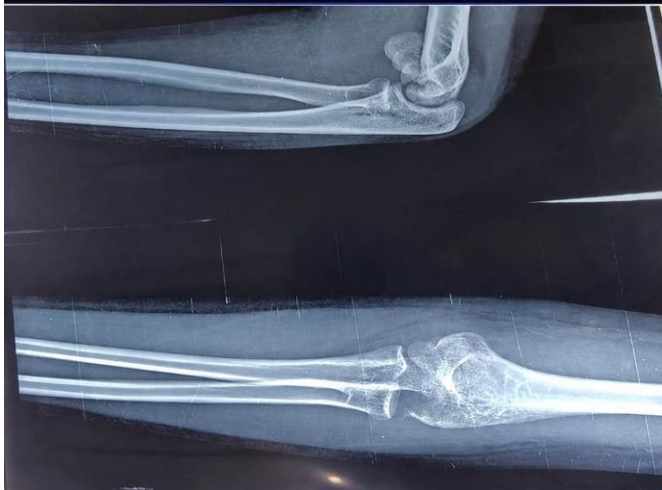


Figure 4A: shows Xray images of type 3B fractures



Figure 4B: shows type 3B fractures treated headless compression screws and distal end humerus plates using posterior approach with olecranon osteotomy

Postoperative care: The splint is taken off after roughly a

week, and the patient is advised to engage in gentle active range of motion activities. If there has been significant intra-articular comminution, the elbow may require immobilization for a longer duration. Passive range of motion and strengthening exercises should not commence until bony healing is apparent, typically around 6 to 8 weeks after surgery. Strengthening routines begin once there is clinical and radiographic confirmation of fracture healing

RESULTS

A total of 7 patients coronal shear fracture of distal humerus underwent surgery. The outcome is assessed using Mayo Elbow Performance Score[MEPS]. Cases were followed up for 12 to 24 months (avg. 18 months). Postoperative Flexion-Extension Arc, Forearm rotation Arc and MEPS score are 135 ± 10 , 169.2 ± 8.2 and 85 ± 10 [Table 1].

Average Time of union is 9 ± 2 weeks. For Type 1 fractures union time was 7-8 weeks, for Type 2 & 3 fractures union time was 9-11 weeks.

Functional range of movements of patient after six months of operation [Figure 5].



Figure 5: shows functional range movements after 6 months followup. A & B shows extension, with terminal extension lag. C & D shows full range of flexion. E shows supination, F shows pronation.

Table 1: showing postop functional outcome result after 6 months

Type	Flexion-Extension ARC	Forearm rotation	MEPS
POSTOPERATIVE	135 ± 10	169.2 ± 8.2	85 ± 10
TYPE 1	140 ± 5	172.5 ± 2.5	92.5 ± 2.5
TYPE 2	135 ± 5	167.5 ± 2.5	87.5 ± 2.5
TYPE 3	130 ± 10	162.5 ± 2.5	80 ± 10

DISCUSSION

Fragment excision was the initial technique used for capitellar fractures with reasonably good outcome. Cadaveric data suggest that capitellar excision does not result in instability when the remaining articular congruity is preserved and ligament constraints are intact.^[5] In contrast, excision of larger fragments that involve the lateral trochlea ridge is likely associated with inferior results because of valgus instability and secondary arthritis, pain and stiffness.^[6] Kirschner wires do not offer compression at the fracture site and usually require subsequent removal. Now independent screw fixation is the most common technique

used for treating coronal shear fractures and is associated with good outcomes in the literature.^[7,8] This is an appropriate technique for more simple fracture patterns, where there is no posterior comminution or bone loss present (Dubberley Type 1A and 2A).^[7,8] A number of screws placed into the articular surface did not cause degenerative changes or persistent pain. Furthermore, the problem of the screw protruding from the cartilage has not arisen. Screw insertion from the posterior side to the articular side is less reliable than screw insertion from the articular side to the posterior side, in our opinion. Even though the lateral approach is less invasive than other surgical procedures, it presents greater challenges for visualising the

trochlea. Even though it is more invasive, the Olecranon osteotomy technique is helpful for seeing the trochlea. Even though there is no difference, we still advise using the lateral procedure when the trochlear site does not require fixing and the olecranon osteotomy approach when it does. Avascular necrosis is uncommon after open reduction and internal fixation of these fractures and the reported incidence of avascular necrosis is 0–30%.^[9] Mckee et al. reported one patient of post-traumatic osteoarthritis in his series of six patients.^[10] In a large series, Lansinger et al. found no case of osteoarthritis of the elbow.^[11] It has been reported that articular cartilage can heal after anatomical reduction and stable internal fixation and joint mobilisation.^[12] For the treatment of capitellum and trochlea fractures, open reduction and internal fixation with Herbert screws are advised since they produce the least amount of articular injury.

CONCLUSION

There is little contemporary literature on capitellum fractures of the distal humerus, and these fractures are rare. Small case series with a variety of classification schemes and therapeutic approaches make up the majority of reports. Concurrent bone and ligamentous injuries are common in these traumas, and postoperative stiffness, joint degeneration, chronic instability, and neuropathy can make treatment more difficult. Stable internal fixation and early range of motion wherever feasible are the ideal treatment options. Utilising a lateral approach Headless compression screws can be used to treat capitellum and trochlea fractures (type 1&2), with satisfactory functional outcomes. Posterior approach using olecranon osteotomy can be used for type 3b fracture patterns. Nevertheless, larger studies are required to better understand these challenging injuries.

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Conflicts of interest

There are no conflicts of interest.

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