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Navigating a Rare Type IV Capitellar fracture: A Case Report and Comprehensive Literature Review

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ABSTRACT

Introduction: Capitellar fractures are rare, accounting for 1% of elbow fractures. A coronal shear fracture of the capitellum extending to the medial ridge of the trochlea is classified as a Type IV capitellar fracture (Mckee). This fracture is often missed on initial presentation because it is not easily visible on the anteroposterior radiograph. 3D Computed Tomography (CT) scans play a vital role in preoperative planning. Open reduction and internal fixation (ORIF) are the preferred treatment, but there is no consensus on the choice of fixation methods. Here, I report a case of a Type IV capitellar fracture managed with ORIF with 4.0mm cannulated screws. **Case Report:** A 15-year-old boy sustained a Type IV capitellar fracture following a fall on an outstretched hand. He underwent ORIF with cannulated screws, placed from posterior to anterior without penetrating the joint surface. He had returned to full normal activities without any restrictions. The radiograph at 6-month follow-up showed good healing without a feature suggestive of avascular necrosis (AVN). **Conclusions:** A high level of clinical suspicion and thorough radiographic assessment are imperative to avoid overlooking capitellar fracture. Although limited studies are available on the use of alternative screws for fixation, 4.0mm cannulated screws serve as a viable alternative to headless compression screws as demonstrated in the above case.

Keywords: Capitellar fracture; Capitellum; Case report; Coronal shear fracture; Distal Humerus.

INTRODUCTION

Coronal shear fracture of distal humerus involving capitellum and trochlea are rare, representing 1% of elbow fractures and 3-6% of all distal humerus fractures[1,2]. These isolated fractures usually occur due to low-energy trauma following a fall on an outstretched hand, where axial loading through the radial head generates vertical shear force on the capitellum[2–4]. The presence of a "double arc sign" in the lateral radiograph of the elbow is pathognomonic for this fracture[5]. The use of a 3D Computed Tomography (CT) scan can greatly enhance fracture comprehension and aid in pre-operative planning[2,5].

Typically, these fractures are managed operatively, mainly due to their intrinsic intra-articular nature and tendency for displacement, which can restrict elbow range of motion[5]. Currently there is no agreed-upon guideline for the choice of fixation method for these fractures and commonly used fixation method includes use of mini-fragment screws, headless screws, and Bioabsorbable pins[5–7]. Here, I present a case that underwent open reduction and internal fixation (ORIF) with 4.0 mm cannulated screws.

CASE REPORT

A 15-year-old male presented to Orthopedic clinic with severe pain and swelling in right elbow following a fall from a ladder on outstretched hand. Clinical examination revealed diffused swelling around the elbow with restricted range of Motion (ROM).

Standard Lateral view radiograph of elbow revealed "double arc sign" (Figure 1). 3D CT scan done for pre-operative planning revealed coronal shear fracture of capitellum extending to medial ridge of trochlea (Figure 2). Fracture was classified as

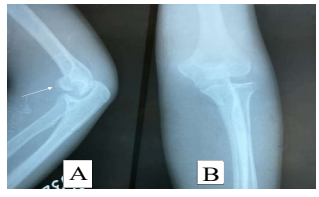

Figure 1. Preoperative Lateral (A) and AP (B) demonstrating "double arc sign" on lateral (White arrow) but fracture not appreciable in AP view

Figure 2. CT scans with 3D reconstruction showing coronal shear fracture of capitellum extending to medial ridge of trochlea (Arrow).

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Type 2A Dubberley's classification and Type IV McKee fracture. He underwent surgery under regional anaesthesia. A pneumatic tourniquet was used. Fracture site was approached through extensile lateral approach with anterior detachment of wrist extensors' common origin along with anterior joint capsule from lateral supracondylar ridge (Figure 3).

After thorough irrigations with normal saline to clear fracture hematoma and soft tissue debris, anatomic reduction was done and held temporarily with small weber clamp. Two 1.25mm threaded guide wires were inserted from posterior to anterior through anticipated screw position, one to capitellum and another to lateral trochlear ridge. Under image intensifier, the position of the guide wire tip was adjusted so that it did not penetrate the joint surface. A pilot screw hole was drilled using cannulated drill bit over the first guide wire, and a 4.0mm partially threaded cannulated screw of appropriate length was inserted; the same step was repeated for the second screw. After confirmation of fixation stability and reduction through passive elbow and forearm ROM, wound was closed in layers and patient was put on long arm posterior splint.

Immediate post operative period was uneventful. One week after the surgery, splint was removed, and passive elbow and forearm ROM were initiated. He used pouch arm sling in between exercises. After two weeks post-operative period, active ROM was allowed; however, weight-bearing activities on the operated limb were restricted for 8 weeks.

He was followed up at 2 months and 6 months following surgery, and he was asymptomatic with full elbow and forearm ROM (Figure 4). He had already returned to full normal activities. There was a good sign of healing with no feature suggestive of avascular necrosis (AVN) on elbow radiograph (Figure 5).

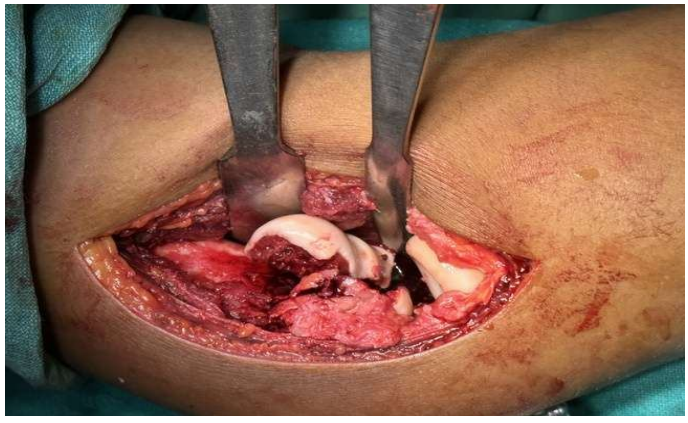

Figure 3. Extended lateral approach to fracture site, showing Type IV Mckee fracture of capitellum

Figure 4. Follow up image at 6 months demonstrating elbow full range of motion

Figure 5. Post operative radiograph taken six months following surgery with good healing and no feature suggestive of AVN of capitellum

DISCUSSION

Fractures involving the capitellum of the distal humerus are a rare occurrence, usually seen in older children and adolescents as the capitellum grows and ossifies[1,2,8].

Detecting these fractures during the initial examination is often difficult since they are not easily appreciated in the AP radiograph of the elbow. Therefore, it is imperative to maintain a high level of suspicion and obtain a true lateral radiographic view to ensure these injuries are not missed[9]. On lateral radiograph, coronal shear fractures of the capitellum are often recognized by the distinctive "double arc sign." and in more comminuted fractures "triple arc sign" can be seen[2,5]. Due to the challenge of accurately discerning fracture details in radiographic images, CT scan with 3D reconstruction plays an invaluable role in pre-operative planning.

While there are various classification systems for these fractures, most of them are descriptive and provide little predictive value for treatment outcomes.

Bryan and Morrey classified capitellar fracture into three subtypes. Type I (Hahn-Steinthal fracture) involves capitellum only with attached subchondral bone; Type II (Kocher-Lorenz fracture) is thin capitellar osteochondral injury, and Type III (Broberg and Morrey) are isolated capitellar comminuted

fractures. Subsequently McKee et al. modified and added Type IV (McKee fracture) which is capitellar fracture extending medially into trochlea[2,3].

Dubberley et al.'s more recent classification system has a significant impact on surgical decision-making and offers valuable prognostic information. Type 1 fracture involves the capitellum with or without the lateral ridge of the trochlea; Type 2 involves the capitellum in continuity with an extension into the trochlea, and Type 3 describes separate capitellum and trochlea fragments. Each type is subdivided into two subtypes: subtype A, where there is no posterior comminution, and subtype B, where posterior comminution is present.

Due to their inherent intra-articular nature and the risk of displacement, which can restrict elbow range of motion, these fractures require ORIF. As a result, the surgical goal is to restore joint congruity, establish stable fixation, and facilitate early initiation of range of motion[5,6]. The complexity of this fracture and its infrequent occurrence have led to a lack of consensus on the optimal fixation method[10]. Screw fixation is the commonly used fixation method, although numerous researchers have suggested considering K-wire fixation and plate fixation as alternative options[1–3,5]. Headless compression screws, like Herbert screws, are commonly used in many studies in the antero-posterior direction, while there is limited research on use of other alternative screw types[2–7,9].

In this case, we opted for 4.0mm cannulated screws in a posteroanterior direction, as our centre lacked headless compression screw facility, despite the limited research available on alternative screw options.

Noted complications after surgery includes elbow stiffness, decreased ROM, instability, non-union, mal-union, heterotopic ossification, and AVN[2,3,5]. In our case, the early implementation of ROM exercises prevented the onset of stiffness, and the ROM in the elbow is similar with that of the uninjured elbow. Follow up radiograph at 6 months following surgery doesn't show feature of AVN of capitellum.

CONCLUSIONS

A coronal shear fracture of the distal humerus is a rare occurrence. It is crucial to maintain a high level of clinical suspicion and perform a thorough radiographic assessment to avoid overlooking such fractures. 3D CT scans are invaluable for pre-operative planning. ORIF is the preferred treatment method to restore joint congruity, establish stable fixation, and facilitate ROM. Many studies have documented the use of headless compression screws to achieve stable fixation. Alternatively, similar stability and positive clinical outcomes can be achieved through ORIF with 4.0mm cannulated screws, directed posterior to anterior, without penetrating the joint surface, as demonstrated in this case. This screw insertion technique minimizes the risk of damaging the articular cartilage during procedure and offers the advantage of easier removal if the patient chooses to do so.

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