

## Posterolateral Shear Fracture of the Capitellum Associated with Elbow Dislocation in Adolescent: A Case Report

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### Abstract

### Case Report

**Background:** Posterolateral shear fractures of the capitellum are extremely rare in adolescents and are typically associated with elbow dislocations. The fracture fragment, involving the posterolateral part of the capitellum and mostly cartilaginous, makes diagnosis difficult. This report describes the case of an adolescent patient with a posterolateral shear fracture of the capitellum associated with elbow dislocation. **Case presentation:** A 13-year-old male presented with a left elbow injury following a fall, resulting in a posterolateral dislocation and associated fracture. After successful reduction, imaging confirmed a type I Hahn-Steinthal posterolateral shear capitellar fracture. Surgical treatment involved open reduction and internal fixation using 3 Kirschner wires (K-wires), with subsequent removal at 4 weeks postoperatively. At the 6-month follow-up, there were no signs of complications, and the patient had achieved a full range of motion. **Conclusion:** Early and accurate diagnosis is crucial in managing pediatric capitellum fractures, which can be distinct in children and adolescents. Selecting a treatment approach that restores articular congruity and joint stability while avoiding intraarticular fragments is paramount. Advanced imaging modalities, such as cross-sectional imaging, are crucial in determining the fracture pattern and guiding treatment decisions.

**Keywords:** Capitellum fracture, Posterolateral shear injury, Elbow dislocation, Adolescents.

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## INTRODUCTION

Capitellum fractures are rare elbow injuries, constituting 6 % of distal humeral fractures and 1% of elbow fractures [1]. As the capitellum grows and ossifies during adolescence, it becomes increasingly susceptible to coronal shear injury [2]. Posterolateral shear injury, a rare subtype of coronal shear fractures of the capitellum, was recently described by Murthy *et al.*, as an isolated fracture of the posterolateral part of the capitellum [3].

Diagnosing this type of fracture can be difficult because of its small size and articular nature, and the fractured fragment, which comprises largely of cartilage components, can be misdiagnosed without proper radiological interpretation [2-5]. Additionally, posterolateral shear injury is typically associated with elbow dislocations, among other accompanied bone fractures such as radial head and lateral epicondyle fractures [3, 6]. This combination of injuries can confound diagnosis, often leading to misdiagnosis during the acute phase [3]. Delayed diagnosis and management

can result in persistent elbow pain and the development of complications, leading to a loss of elbow range of motion [3-5].

This report describes a case of posterolateral shear fracture of the capitellum associated with elbow dislocations in a 13-year-old boy.

## CASE PRESENTATION

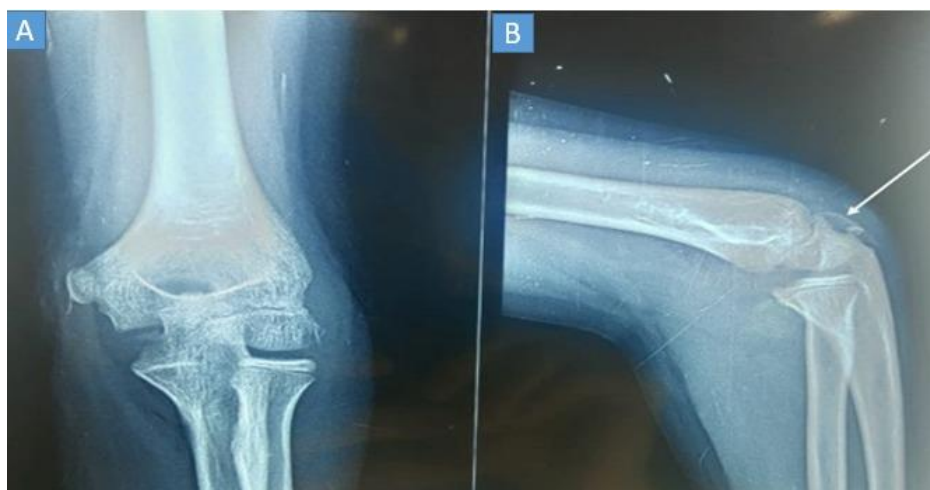
A 13-year-old male presented to our pediatric hospital's emergency department following a fall with an outstretched left non-dominant arm. He exhibited swelling, deformity, and limited extension and flexion of the elbow. The neurovascular examination of the arm was normal. Initial X-rays showed a posterolateral dislocation with suspicion of an associated fracture (**Figure 1**). Closed reduction was carried out in an emergency unit immediately. Post-reduction X-ray revealed a successful reduction, with suspicion of a capitellum fracture (**Figure 2**). A Computed tomography (CT) scan was performed for further evaluation, confirming an isolated posterolateral shear capitellum

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fracture classed as Type I (Hahn – Steintal) according to the Bryan-Morrey classification and Type IIb according to the Murthy *et al.*, classification (**Figure 3**).



**Figure 1:** Initial X-rays of the left elbow showed a posterior-lateral dislocation and an associated fracture (the arrow). Initial plain radiograph in lateral view



**Figure 2:** Post-reduction X-rays A. anterior-posterior and B. lateral; showed a successful reduction of the dislocation, with suspicion of a capitellar fracture (the arrow)



**Figure 3:** CT scans three-dimensional reconstruction lateral (A, B) and anteroposterior (C) view depicting a fractured posterolateral fragment of the capitellum

The patient undergoes surgical treatment 24 hours post-injury to allow the organization of a CT scan. An open lateral approach was performed with anterior detachment of the extensor mechanism. Homann retractors were placed on each side of the distal humerus, and a radiocapitellar arthrotomy was performed. The articular surface was visualized, after the evacuation of the hemarthrosis, and the posterolateral shear fracture

was identified and was reduced under direct visualization (**Figure 4: A**). Fixation was then achieved by 3 posterior-to-anterior smooth Kirschner wires (**Figure 4: B**). The patient was discharged the next day with an above-elbow half-cast. Paracetamol and non-steroidal anti-inflammatory drugs (indomethacin) were used as analgesics.



**Figure 4: A. An intraoperative view showed the fracture with a frontal line detaching the posterolateral part of the capitellum B. intraoperative view after fixation**

Postoperative X-rays (**Figure 5**) and follow-up showed satisfactory progress, leading to the removal of the half-cast and wires at 4 weeks and the subsequent application of a hinged elbow brace for progressive

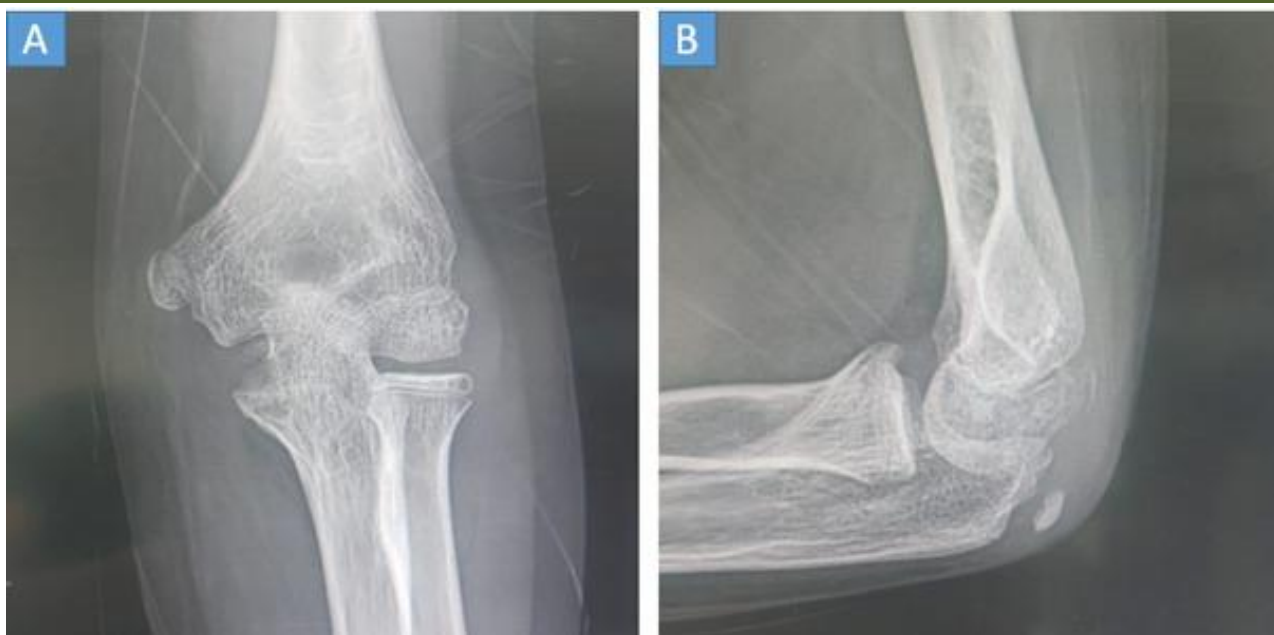
mobilization. The brace was removed at 6 weeks, allowing full mobilization, and by then, the fracture had healed.



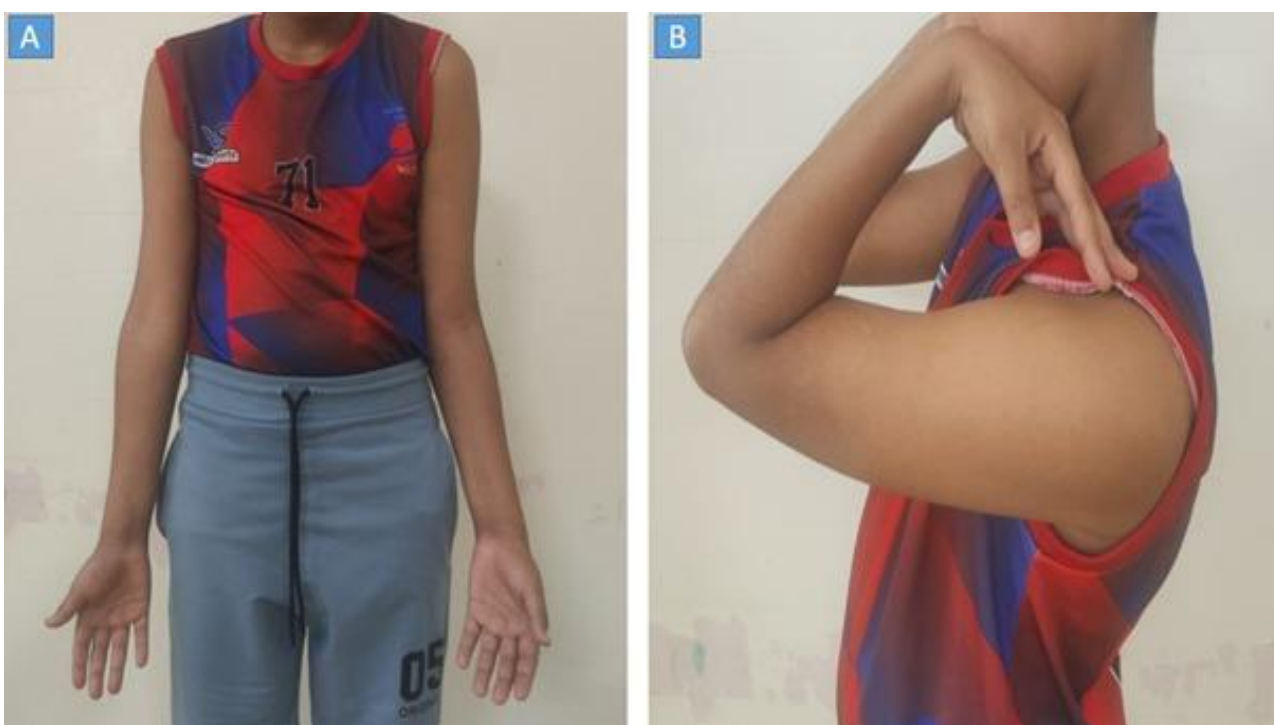
**Figure 5: Immediate post-operative X-ray A. anteroposterior view B. lateral view**

At the 6-month follow-up, there were no radiological signs of complications (**Figure 6**). The patient had returned to full activities with a range of

motion of 0°–135°, with a 5° extension deficit compared to the uninjured side (**Figure 7**). However, he did not report any complaints.



**Figure 6: Six months postoperative X-ray A. anteroposterior view B. lateral view showing healing and no evidence of avascular necrosis**



**Figure 7: Patient review 6 months postoperative A. elbow extension. B. elbow flexion**

#### Ethical Approval and Informed Consent

Ethical approval was not required for the report in this case.

Written informed consent was obtained from the patient and their parents for the publication of this case.

## DISCUSSION

Capitellum fractures are uncommon in children and adolescents [1]. Furthermore, coronal shear fractures

are rare in children under 12 years old due to the cartilaginous structure of the distal humerus [7,8]. In children, traumatic shear forces acting on the distal humeral epiphysis more often cause lateral condyle fracture. As the humerus ossifies, susceptibility to capitellum fractures increases [1].

The combination of a posterolateral shear capitellum fracture with elbow dislocation is an exceptionally rare injury in the pediatric population. As reported in the literature to our knowledge, only Murthy

*et al.*, described 9 cases of posterolateral shear capitellum fractures in a series of 37 patients, of which 8 were displaced, and 6 were associated with ulnohumeral dislocation [3].

The Bryan-Morrey classification is the most commonly used in adults [1]: Type I. Hahn - Steinthal isolated capitellum fracture. Type II. Kocher - Lorenz fracture of the capitellum cartilage rim, type III. comminuted capitellum fractures and type IV. (added by McKee *et al.*,) Capitellum and trochlea fracture [9].

Recently, a new classification system for pediatric and adolescent capitellum fractures was proposed by Murthy *et al.*, [3]. Type I are anterior shear injuries, analogous to the Hahn-Steinthal fractures. Type II are posterolateral shear injuries, an entity that has not been described previously. Type III are chondral shear injuries, analogous to Kocher-Lorenz fractures. Type a. nondisplaced. Type b. displaced.

Our case is consistent with a posterolateral shear injury classified as type I (Hahn-Steinthal fracture) according to the adult classification or type IIb according to the pediatric classification of Murthy *et al.*,

The typical clinical symptoms include swelling, pain, and limited active and passive elbow motions, displaced capitellum fractures typically block motion, particularly flexion and extension [10]. Common causes of capitellum fractures include falls onto an outstretched arm, direct blows to the elbow, or high-energy mechanisms like motor vehicle accidents [11].

Capitellum fractures can be missed, particularly on anteroposterior X-rays [12, 5]. True lateral X-rays are considered most helpful for accurate diagnosis [13,14]. A characteristic sign described in the literature is a double arch, which is typical for type IV fractures according to the Bryan and Morrey classification [1]. In our case, lateral X-rays enabled us to suspect the diagnosis as quickly as possible. Upon retrospective review of the initial X-ray images, thin small bone fragments posterior to the humerus capitellum were evident in the lateral X-rays (**Figures 1B, 2B**).

Ultrasonography is useful for detecting humeral capitellum fractures in the skeletally immature population [15]. It can assist in the diagnosis, even when the range of motion testing is limited due to pain. Ultrasonography is a simple and minimally invasive method for evaluating articular cartilage and subchondral bone. Computed tomography (CT) is recommended for preoperative planning in capitellum fractures. Three-dimensional CT can be particularly helpful in understanding the fracture pattern and identifying small articular fragments and comminution [16].

Another challenge in diagnosing capitellum fractures is that they might be complicated by elbow

dislocation or other fractures such as radial head fractures and lateral epicondyle fractures, which are the most commonly associated with capitellum fractures [3,6]. The present case involved a capitellum fracture associated with elbow dislocation. The complexity of diagnosing multiple bone injuries in a single case can lead to missed diagnoses [17], particularly in children, where bone fragility can further complicate the exact diagnosis of multiple bone injuries around a single locomotor unit.

The rarity of these injuries explains the lack of consensus on treatment. As with any articular fracture, reduction is permissible as soon as the inter-fragmentary gap exceeds 2 mm.

Overall, surgical fixation of displaced anterior shear fractures had good results but provided limited information on the acute management of other common pediatric fracture patterns or relevant complications such as osteonecrosis [3,4,18]. Options for fixation of the fracture fragment include K-wires, headless screws, headed cannulated screws, and double horizontal mattress sutures [3,2].

other options include cast immobilization for nondisplaced capitellum fractures for 3 to 6 weeks, which generally had poor results [3, 8,18]. Fragment excision is less common now, except for small fragments unsuitable for fixation, or delayed diagnosis [3,19, 4].

In our case, we performed open reduction through a lateral approach with K-wires fixation. We consider open reduction to be the optimal approach for restoring joint congruency and facilitating early elbow mobilization. Regardless of the type of fixation, we emphasize the importance of achieving gentle, atraumatic anatomical reduction and avoiding dissection of the posterolateral column of the humerus to preserve its fragile vascularization. Capitellar osteonecrosis and post-traumatic elbow arthrosis are the two main complications of joint fracture treatment [3,10,13]. Mahirogullari *et al.*, [13] reported an osteonecrosis incidence of 0–30%, while Murthy *et al.*, [3] found that 24% of patients developed symptomatic osteonecrosis.

## CONCLUSIONS

The posterolateral shear fracture of the capitellum is a rare injury in children, frequently associated with elbow dislocations. Diagnosis can be challenging and may be missed without proper radiological interpretation. Advanced imaging, such as three-dimensional CT, can help determine the fracture pattern and guide treatment. Early and accurate diagnosis is crucial for effective management in children and adolescents. Treatment should focus on restoring joint congruity and stability while avoiding intra-articular fragments.

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