

A Rare Adolescent T–Y Distal Humerus Fracture with Capitellar Shear Component Managed Using a Triangular Cannulated Screw Construct and Herbert Screw Fixation: A Rare Case Report

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Learning Point of the Article:

Complex adolescent T-condylar distal humerus fractures should undergo CT evaluation to identify associated articular injuries, and a triangular cannulated cancellous screw construct combined with Herbert screw fixation provides rigid fixation, facilitates early mobilization, and can achieve excellent functional outcomes in rare intra-articular distal humerus fracture patterns.

Abstract

Introduction: T-condylar (T–Y) distal humerus fractures are rare intra-articular injuries in adolescents (<2% of pediatric elbow fractures). The coexistence of a capitellar coronal shear fragment is exceptionally uncommon and can be easily missed on radiographs. We report successful management of this rare injury using computed tomography (CT)-guided planning and stable screw fixation.

Case Report: A 12-year-old boy presented after a fall with a displaced T-condylar distal humerus fracture. CT demonstrated an associated capitellar coronal shear fragment. Open reduction through a posterior paratricipital approach was performed using a triangular cannulated cancellous screw construct with Herbert screw fixation of the capitellum. Fracture union was achieved uneventfully, implants were removed after union, and the patient regained nearly full elbow motion without deformity, instability, or neurovascular deficit.

Conclusion: Pre-operative CT is crucial for identifying associated capitellar injuries. A triangular cannulated screw construct combined with Herbert screw fixation provides stable fixation, facilitates early mobilization, and can achieve excellent radiological and functional outcomes in selected adolescent T-condylar fractures.

Keywords: T-condylar distal humerus fracture, adolescent elbow fracture, capitellar shear fracture, Herbert screw fixation, cannulated cancellous screw.

Introduction

Fractures around the pediatric elbow are common; however, T-condylar distal humerus fractures represent one of the rarest injury patterns, accounting for <2% of all pediatric elbow fractures. These injuries occur predominantly in older children and adolescents because of the progressive ossification and maturation of the distal humerus. Unlike conventional

supracondylar fractures, T-condylar fractures extend into the articular surface and therefore require precise reduction and stable fixation to restore elbow congruity and function.

The mechanism of injury is typically a direct impact on a flexed elbow, resulting in splitting of the distal humerus into medial and lateral condylar fragments. Failure to recognize the intra-articular extension may result in malunion, stiffness, loss of

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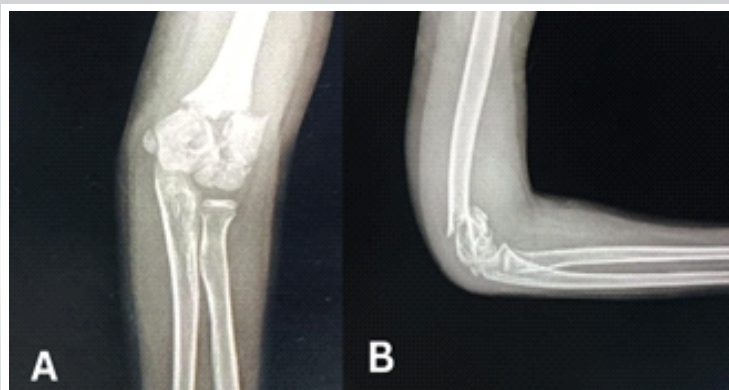


Figure 1: Immediate post-traumatic X-rays of right elbow (a) anteroposterior view, (b) lateral view.

motion, post-traumatic arthritis, and deformity. Several studies have emphasized that high-quality imaging and anatomical reconstruction are essential to achieving favorable outcomes.

Computed tomography (CT) has become increasingly important in delineating fracture morphology, particularly in adolescents, in whom the fracture pattern often resembles the adult distal humerus fracture. Associated capitellar coronal shear fragments are uncommon and can be difficult to identify on plain radiographs alone. Their presence further complicates treatment and necessitates restoration of radiocapitellar congruity.

Although Kirschner-wire fixation remains the standard treatment for many pediatric distal humerus fractures, complex intra-articular fracture patterns often require more rigid fixation. Screw fixation provides compression across fracture surfaces and may facilitate earlier mobilization. We report a rare case of a CT-confirmed adolescent T-condylar distal humerus fracture associated with a capitellar coronal shear fragment managed successfully using a triangular cannulated cancellous screw construct and Herbert screw fixation through a posterior paratricipital approach.

Case Report

Patient information

A 12-year-old right-hand dominant male presented to the emergency department with severe pain, swelling, and inability to move the right elbow following a self-fall injury. There was no history of previous elbow pathology, and he was otherwise healthy.

Clinical findings

On examination, diffuse swelling and tenderness were present around the elbow. The injury was closed, with no skin compromise. Distal neurovascular examination was normal, and there was no evidence of radial, median, or ulnar nerve injury or vascular compromise.

Diagnostic assessment

Anteroposterior and lateral radiographs of the elbow demonstrated a displaced intra-articular distal humerus fracture with a T-Y configuration and supracondylar extension. Because of suspicion of a complex intra-articular injury, CT imaging with three-dimensional reconstruction was obtained (Fig. 1).

CT imaging confirmed a T-condylar distal humerus fracture with intercondylar separation and supracondylar extension. Additionally, a displaced capitellar coronal shear fragment was identified, which was not fully appreciated on conventional radiographs (Fig. 2).

Therapeutic intervention

Given the intra-articular displacement and complexity of the fracture pattern, operative treatment was planned. Surgery was performed within 12 h of injury under general anesthesia.

A posterior paratricipital approach was utilized to preserve the extensor mechanism while allowing adequate visualization of

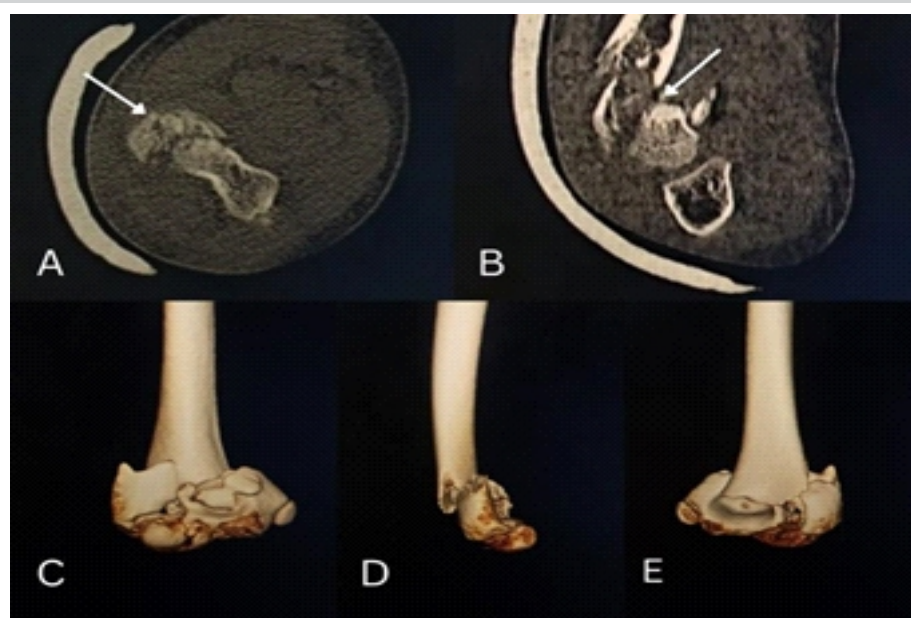


Figure 2: Pre-operative computed tomography (CT) images of right elbow. (a) Axial (b) sagittal view with white arrow indicating the fracture line of the T-shaped distal humerus fracture with capitulum shear fracture. (c, d, e) 3D reconstruction of the CT scan.

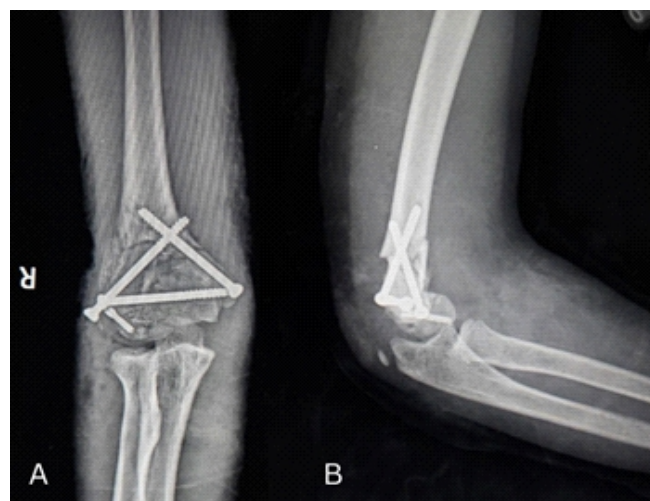


Figure 3: Immediate post-operative X-rays showing triangular construct CC screw fixation of distal humerus fracture with Herbert screw fixation of capitulum fragment. (a) Anteroposterior view, (b) lateral view.

the articular surface. Intraoperatively, significant displacement and rotation of the intercondylar fragment were noted.

The articular surface was anatomically reduced first. A transverse cannulated cancellous screw was inserted across the condyles to achieve intercondylar compression. The supracondylar component was subsequently stabilized using two obliquely directed cannulated cancellous screws inserted proximally, creating a triangular fixation construct. This configuration provided stable fixation and rotational control of the distal humerus.

The capitellar coronal shear fragment was then reduced and fixed with a Herbert screw, restoring radiocapitellar congruity while minimizing hardware prominence (Fig. 3).

Post-operative management

Post-operative radiographs confirmed satisfactory reduction and fixation. The limb was immobilized in an above-elbow splint. Following wound healing, supervised range-of-motion exercises were initiated.

Outcome and follow-up

The patient was routinely followed up at 1 month, 6 months, and 12 months, respectively. Serial radiographs demonstrated progressive union without loss of reduction or implant failure. Functional scores such as the Mayo Elbow Performance Score (MEPS), Flynn Criteria, and QuickDASH score were calculated at these intervals (Table 1 and Fig. 4).

At final follow-up, the fracture had united completely. The patient underwent implant removal after 1 year, following which the patient achieved near-full elbow flexion of 115° and extension deficit of 5° with forearm pronation and supination of

Table 1: MEPS, QuickDASH, and Flynn's criteria grading for 1, 6, and 9-month follow-up post-operative status

Follow-up	MEPS (0–100)	QuickDASH (0–100)	Flynn's criteria
1 month	55	68.2	Poor (>15° loss of motion)
6 months	90	9.1	Good (6–10° loss of motion)
1 year	100	0	Excellent (≤5° loss of motion and carrying angle)
MEPS: MAYO Elbow Performance Score			

approximately 80–90°. No residual deformity, instability, heterotopic ossification, cubitus varus, cubitus valgus, infection, or neurovascular deficit was observed (Fig. 5 and 6).

The patient returned to routine daily activities and sports participation without pain or functional limitation.

Discussion

T-condylar distal humerus fractures account for <2% of pediatric elbow fractures and occur mainly in older children

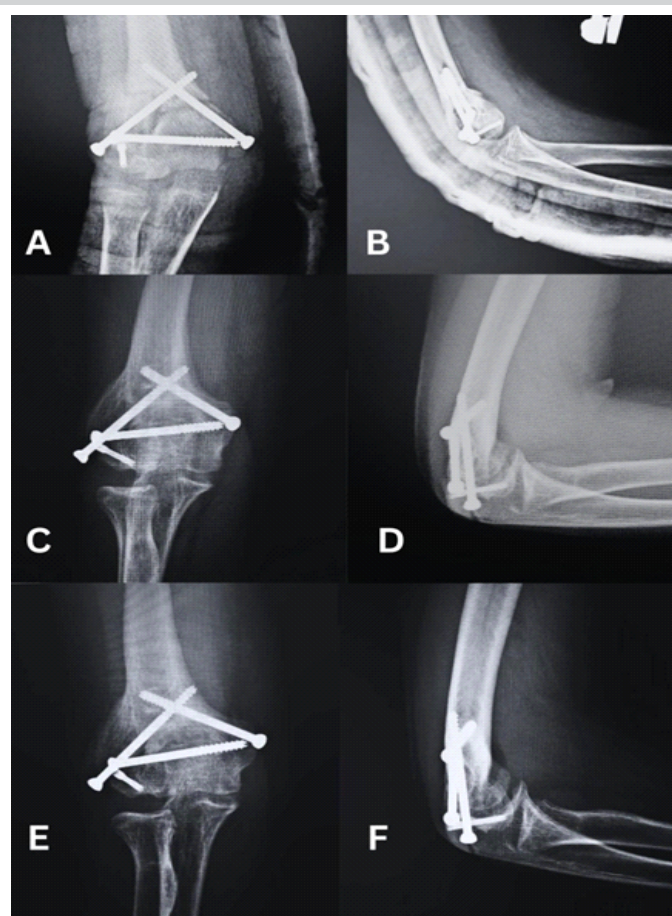


Figure 4: Post-operative follow-up X-ray images at (a and b) 1 month, (c and d) 6 months, (e and f) 12 months.



Figure 5: Post-operative follow-up X-ray images after implant removal at 1 year.

because of progressive distal humeral ossification [1,2]. Popkin et al. and Ducic et al. highlighted their rarity, diagnostic difficulty, and need for anatomical reduction [3,4].

Our case is unusual because of the associated capitellar coronal shear fragment, a combination rarely reported. CT accurately defined the fracture pattern and guided surgical planning, identifying injuries that may be overlooked on plain radiographs [3,4]. Uncommon distal humeral fracture patterns are associated with higher complication rates than extension-type injuries, reinforcing the need for careful assessment of atypical elbow trauma [5].

Displaced intra-articular T-condylar fractures generally require open reduction and internal fixation to restore articular congruity and permit early motion, as found in systematic reviews [4,6]. Although K-wire fixation is suitable for selected fractures, screw fixation offers superior compression and rotational stability, particularly in complex patterns [7,8,9].

We used a transverse intercondylar screw with two oblique cannulated screws forming a triangular construct, together with Herbert screw fixation of the capitellum. This provided rigid fixation, maintained reduction, and allowed progressive rehabilitation. Reports describing this construct combined with capitellar fixation in adolescents are extremely limited [10,11].

The posterior paratricipital approach provided excellent exposure while preserving the extensor mechanism and avoiding olecranon osteotomy-related morbidity [4,6]. Stable fixation enabled early mobilization, and the patient achieved excellent MEPS, Flynn criteria, and QuickDASH outcomes with complete union.

Our findings reinforce key principles

CT-based assessment, meticulous anatomical reduction, stable fixation, recognition of associated capitellar injuries, and structured rehabilitation are essential for successful management of these rare fractures. This case adds to the limited literature on adolescent T-condylar fractures with capitellar shear fragments. Long-term follow-up studies demonstrated that even when radiographic union is achieved, residual elbow stiffness and carrying angle abnormalities may persist if anatomical reduction is not restored, emphasizing meticulous reconstruction of the articular surface [12].

Conclusion

CT-confirmed adolescent T-condylar distal humerus fractures associated with capitellar coronal shear fragments represent exceptionally rare and complex injuries. Accurate pre-operative characterization using CT imaging is essential for understanding fracture morphology and planning treatment. Stable fixation using a triangular cannulated cancellous screw construct combined with Herbert screw fixation can achieve anatomical reduction, reliable union, and excellent functional outcomes. This technique offers a reproducible option for managing selected adolescent intra-articular distal humerus fractures while facilitating early rehabilitation and restoration of elbow function.

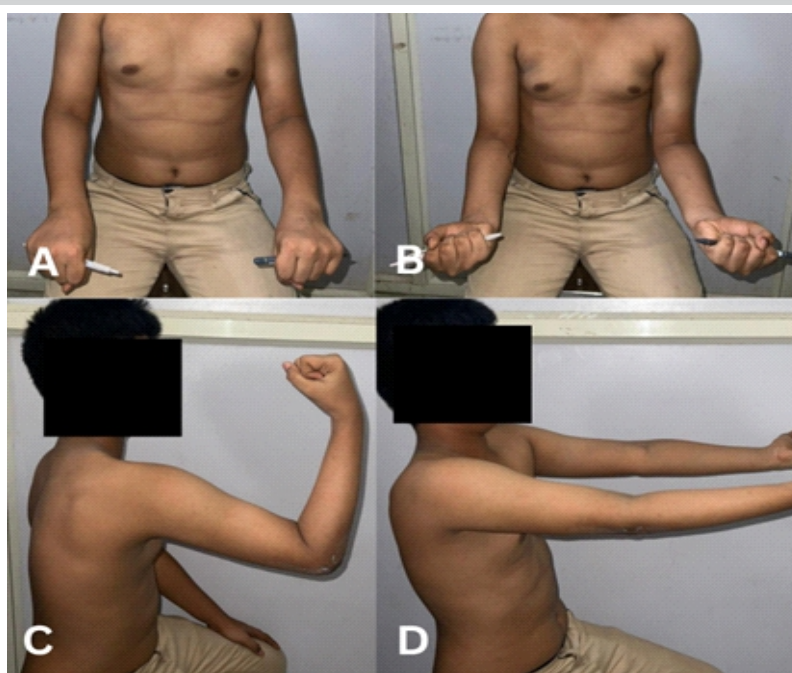


Figure 6: Post-operative clinical images depicting (a) pronation, (b) supination, (c) flexion, and (d) extension at 1-year follow-up.

Clinical Message

Rare adolescent T-condylar distal humerus fractures may harbor associated capitellar shear fragments that are easily missed on plain radiographs. Pre-operative CT evaluation and stable anatomical fixation using a triangular cannulated screw construct with Herbert screw fixation can provide excellent articular restoration, reliable union, and near-normal elbow function.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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