Treatment of a Pediatric T-type Intercondylar Humerus Fracture With Hybrid Percutaneous Pinning and External Fixation

D. Alex Stroh, MD; Brian T. Sullivan, BS; Brett A. Shannon, MD; Paul D. Sponseller, MD, MBA

Abstract

T-type intercondylar fractures of the distal humerus are rare injuries in skeletally immature patients. Few studies are available to guide the treatment of these injuries. Small case series and expert recommendations suggest superiority of the open approach for direct reduction of the articular surface. This approach poses risks of vascular compromise and elbow stiffness. However, success with percutaneous intercondylar screw fixation has been described for simple split patterns. The authors present a case that illustrates a novel percutaneous technique to treat this fracture type. A healthy 8-year-old boy sustained a T-type intercondylar fracture of the distal humerus (AO 13-C1). Excellent reduction was noted after closed reduction and crossed percutaneous pinning. Compression was applied across the pins through a small external fixator bar to address the intercondylar split component. At the 6-week postoperative clinic visit, the pins and fixator were removed uneventfully, and normal healing with full range of elbow motion was noted. This case report describes a simple, minimally invasive technique to treat uncomplicated T-type intercondylar fractures of the distal humerus in skeletally immature patients. Practitioners familiar with percutaneous fixation of supracondylar fractures can easily perform this technique. The described technique spares an open dissection and avoids permanent implants around the joint. Further multicenter research is warranted to determine the long-term outcomes and safety of the described technique. [Orthopedics. 201x; xx(x):xx-xx.]

Although supracondylar fractures of the distal humerus are common, intercondylar fractures are relatively rare in the pediatric population.1,2 Preoperative radiographs often reveal the intercondylar component, but suboptimal positioning may conceal the articular split of presumed supracondylar fractures. In those cases, intraoperative fluoroscopy may identify articular extension of the fracture.

Given the infrequency of T-type intercondylar fractures, they have been described in only a few small case series. Among these, an open approach was typically chosen for reconstruction of complex intra-articular injuries, which are more often seen in adolescents.3-8 Small case series and expert recommendations suggest superiority of the open approach for direct reduction of the articular surface. However, success with percutaneous intercondylar screw fixation has been described for simple split patterns, which are more typically seen in young children.9-11 The greater soft tissue dissection required in open approaches theoretically increases the risks of vascular compromise and elbow stiffness compared with percutaneous intercondylar screw fixation.

The authors present a case of an intercondylar distal humerus fracture in a...
young boy effectively treated with a hybrid percutaneous pinning and external fixation technique. The authors describe the simple steps for replication of this technique and its potential advantages and disadvantages.

**Case Report**

A healthy 8-year-old boy fell at a height of approximately 2.4 m from a tree onto his dominant right elbow. He presented to the emergency department with a painful, swollen elbow and was found to have a closed injury with no evidence of neurologic or vascular compromise. Diagnostic radiographs showed a Gartland type III supracondylar fracture and intercondylar humerus fracture with a T-type pattern along with a simple fracture line that extended to the articular surface (Figure 1). After discussion with the family, he was taken to the operating room for surgical intervention with closed reduction and percutaneous pinning.

Combined medial and lateral pinning with large-diameter smooth Steinmann pins was selected, given the uncertainty of purchase in the comminuted medial metadiaphyseal cortex. The medial pin was inserted first, using a small incision and visualization to avoid the ulnar nerve. The pin was used to “joystick” the fracture out of varus and apex anterior alignment and then was driven up the medial column through the lateral metadiaphyseal cortex. The lateral pin was inserted percutaneously and secured in the lateral column. Intraoperative imaging confirmed the suspected intercondylar split. The articular fracture was then compressed by applying a small AO external fixator bar between these 2 pins (Figure 2), closing the fracture gap.

**Figure 1:** Preoperative anteroposterior radiograph of the right elbow of an 8-year-old boy after a fall. An intercondylar humerus fracture with a T-type pattern along with a simple fracture line that extended to the articular surface is shown.

**Figure 2:** Photographs of the right elbow (A) and upper extremity (B) of an 8-year-old boy with a small AO external fixator bar between 2 pins. Intraoperatively, hand compression was observed after reduction and percutaneous pinning.

**Figure 3:** Postoperative anteroposterior (A) and lateral (B) radiographs of the right elbow of an 8-year-old boy who presented with an intercondylar T-type fracture. Progression of healing and grossly anatomic alignment is shown 6 weeks after medial and lateral percutaneous pin placement.
The patient’s arm was protected for 6 weeks in a well-padded posterior slab fiberglass splint. After 6 weeks, the fixator and pins were removed in the clinic uneventfully. On physical examination, the patient had a strong radial pulse, nearly full range of motion, and minimal pain. Radiographs showed good bone healing with maintenance of reduction (Figure 3). Six months postoperatively, the patient had full range of motion and minimal rigidity of the right elbow.

**DISCUSSION**

Classic principles of fracture management evoke the need for direct reduction for perfect alignment of articular fractures, followed by compression for primary bone healing. For simple intercondylar split patterns of the distal humerus, this can be achieved by lag screw fixation laterally or medially across articular fragments or, as described in the current case, with compression via an external fixator construct. The current technique is simple, cost-effective, and familiar to most orthopedic surgeons, and it avoids permanent implants around the joint. This technique is also percutaneous. This less invasive approach saves dissection but does not permit visualization of the articular surface. Substantial limitations to range of motion after open approaches to these fractures were common in the case series reported; however, functional deficits were uncommon. Unlike lateral-only pinning, crossed pinning is a technique that can stabilize the supracondylar component effectively despite minor medial cortical comminution.

The current technique has some disadvantages. The external fixator apparatus may be vulnerable to patient manipulation, so splinting or casting is still advisable. Bars positioned too close to the skin could cause pressure necrosis. Finally, medial pins positioned too close to the skin could cause pressure necrosis. Finally, medial pinning poses a risk to the ulnar nerve. Bars positioned too close to the skin could cause pressure necrosis. Finally, medial pinning poses a risk to the ulnar nerve. Bars positioned too close to the skin could cause pressure necrosis. Finally, medial pinning poses a risk to the ulnar nerve.

Unlike lateral-only pinning, crossed pinning is a technique that can stabilize the supracondylar component effectively despite minor medial cortical comminution.

The current technique may be useful in planned fixation of simple T-type intercondylar fractures of the distal humerus or as a conversion after unexpected intraoperative imaging of a presumed supracondylar fracture. Fractures with more complex articular involvement may not be amenable to this technique. Further multicenter research is warranted to determine the long-term outcomes and safety of hybrid percutaneous pinning and external fixation for these rare pediatric intercondylar distal humerus fractures.

**CONCLUSION**

The current technique may be useful in planned fixation of simple T-type intercondylar fractures of the distal humerus or as a conversion after unexpected intraoperative imaging of a presumed supracondylar fracture. Fractures with more complex articular involvement may not be amenable to this technique. Further multicenter research is warranted to determine the long-term outcomes and safety of hybrid percutaneous pinning and external fixation for these rare pediatric intercondylar distal humerus fractures.

**REFERENCES**