

Cannulated Screw Dethreading During Fixation for a Pediatric Distal Humerus Fracture

Madhish Patel, DO¹; Carter Clement, MD²

¹Ascension Genesys Hospital, Grand Blanc, MI; ²Children's Hospital New Orleans, New Orleans, LA

Abstract: Displaced pediatric distal humerus medial condyle fractures are rare and typically undergo operative intervention to restore the articular surface. Among the various surgical techniques available, fixation with cannulated screws or Kirschner wires are most commonly utilized with good outcomes. The purpose of the current case study is to present a unique instance of cannulated screw failure during open reduction and internal fixation of a displaced pediatric distal humerus medial condyle fracture.

Key Points:

- Self-tapping screw threads can strip when engaging in thick cortices.
- Verify the integrity of the threads using fluoroscopy.

Introduction

Medial condyle fractures in the pediatric population are rare, accounting for less than 1% of fractures about the elbow.¹ They are typically seen in children between ages 8-14 and can follow a fall on a flexed elbow, causing the sharp semilunar notch of the olecranon to split the trochlea.² They can also occur following a fall with an extended elbow resulting in a valgus moment at the elbow.^{3,4,5} In the very young, these fractures can be confused with a medial epicondyle fracture which is extra-articular and usually does not have a positive posterior fat pad sign.⁶ Detecting intra-articular extension on radiographs is difficult before the trochlear ossification center appears. At times, just a small wafer of the metaphyseal ossification center can displace as a unit with the medial epicondyle. In older children, a large medial metaphyseal fragment is often obvious on plain radiographs. The most common fracture line traverses the apex of the trochlea, which is believed to be a point of weakness. Older children tend to have relatively more displaced fractures than younger children

and, consequently, nonoperative results are often not as satisfactory⁷. In cases with a questionable fracture pattern, an arthrogram or advanced cross-sectional imaging may be indicated.⁹ Open reduction and internal fixation for displaced fractures is most often recommended with cannulated screws or Kirschner wires. We present a case of a medial condyle fracture that underwent open reduction and internal fixation with cannulated screws highlighting a unique case of intraoperative hardware failure.

Case Report

A 13-year-old right hand dominant healthy male sustained a fall on an outstretched hand resulting in a displaced medial condyle fracture (Figure 1). After discussing the different treatment options with the patient and family, a decision to proceed with operative fixation was made. The patient was placed in a supine position under general anesthesia with the affected extremity on an arm board. The extremity was then

exsanguinated with an Esmarch and pneumatic tourniquet utilized. A medial approach to the elbow was utilized to expose the fracture site. Under direct visualization, the fracture was anatomically reduced, and reduction was confirmed under fluoroscopy. Guide pins for 4.5mm cannulated screws were advanced up the medial column and from the

lateral side along the “spindle” of the distal humerus transversely using fluoroscopy to confirm anatomic reduction of the fracture. We then opened the outer cortex of the medial column for screw placement using a 3.2mm cannulated bit; the proximal fracture fragment was not drilled or tapped. A cannulated partially threaded screw was advanced. However, upon full insertion, fluoroscopy demonstrated that the threads had been stripped and had exited the cortex through the fracture site into the adjacent soft tissue (Figure 2). The screw was removed over the guide pin; the stripped thread, which had broken free from the screw, was very carefully removed from soft tissue. The path of the screw was then tapped, and a shorter screw was inserted with excellent purchase. The guide pin of the transverse

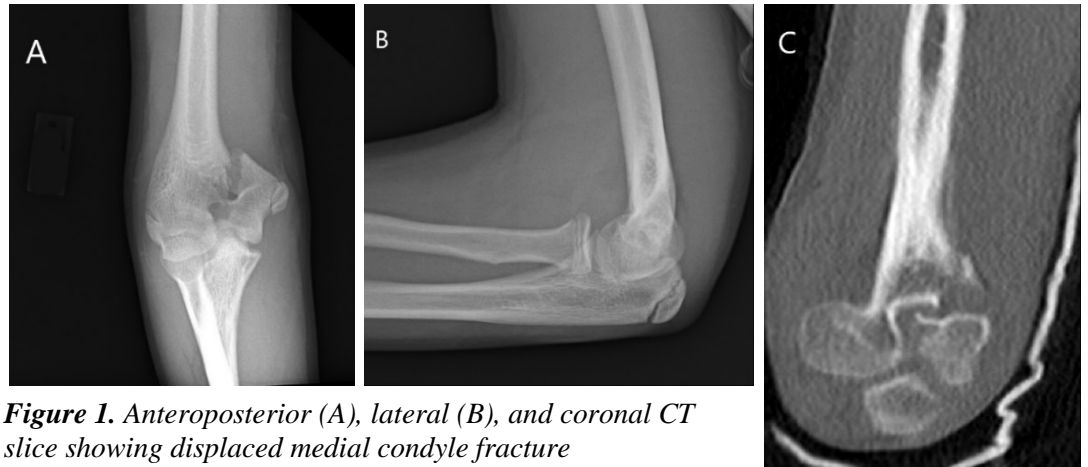


Figure 1. Anteroposterior (A), lateral (B), and coronal CT slice showing displaced medial condyle fracture

pin was then over-drilled to breach the lateral cortex, and an appropriate depth screw was placed over the pin. Final fluoroscopic AP, lateral, and 45° oblique images demonstrated satisfactory fracture alignment, stability, and hardware position. The surgical site was then copiously irrigated and layered wound closure performed. The operative extremity was immobilized in a posterior slab long arm splint.

Discussion

The role of partially threaded screws in fracture management is to achieve compression without having to over drill the proximal fragment, as would be needed if fully threaded screws were chosen. In this case, Synthes 4.5mm self-tapping long threaded, stainless steel cannulated screws were utilized. While we cannot

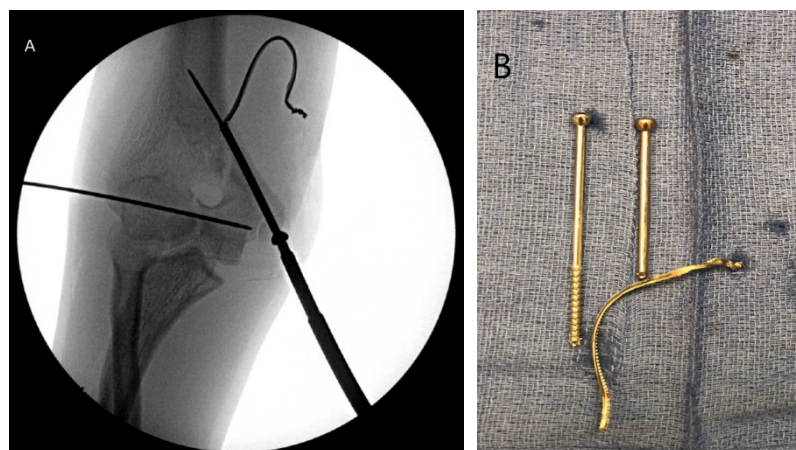


Figure 2. Fluoroscopic image (A) and gross image with normal comparison (B) of the stripped screw threads

rule out a one-time manufacturing error in this particular screw, we postulate that the mode of failure was stripping of the screw thread in shear as it crossed the fracture site and engaged the thick cortex on the proximal side of the fracture line. Stainless steel is 13 times stiffer than cortical bone. However, this value can vary based on implant geometry and fabrication methods⁸, as can be demonstrated in this case.

We were able to salvage the fixation by tapping and reinserting a new screw. The new screw was shorter in length compared to the failed screw. A longer screw would have been preferable since we now

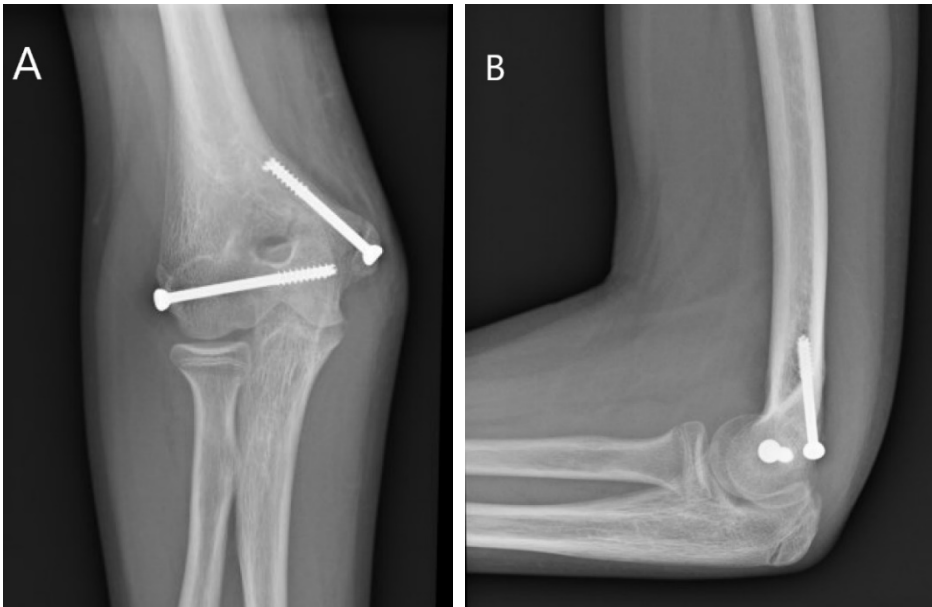


Figure 3. Anteroposterior (A) and lateral (B) radiographs at 10 weeks showing well-maintained fracture reduction, joint congruity, and stable hardware

believe the screw threads sheared off at the fracture line and would have likely obtained better purchase proximal to the fracture site with better fracture compression. Fortunately, in this case, this discrepancy did not result in any complications.

The patient had no complications postoperatively and follow up at 10 weeks (Figure 3) revealed he had returned to light activity, which included shooting basketballs. He was not taking any pain medications and demonstrated full range of elbow motion and full strength in all planes of motion without any neurovascular compromise.

In conclusion, we recommend being mindful of cannulated screws as they pass in close proximity to thick cortices, especially if bone has not been drilled and tapped. In this instance, the threads have the potential to obliquely engage with hard thick bone and lead to mechanical failure of the screw, as demonstrated in this case. Going forward, we will be more likely to tap these areas rather than simply drilling the outer cortex and relying on the self-tapping capability of the screw.

Additionally, we will be more likely to verify the integrity of the threads during screw insertion using fluoroscopy.

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