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Management of medial epicondyle nonunion with open reduction internal fixation and interposition distal clavicle autograft: a case report

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Medial epicondyle fractures account for up to 20% of all pediatric and adolescent elbow fractures.[1,5,6] Nonoperative management is often advocated for fractures with no or minimal displacement on radiographs; however, recent studies have shown that standard radiographs are insufficient to accurately measure the amount of fracture displacement when compared to computed tomography.[2] Medial epicondyle nonunion after nonoperative management has been reported in 50%-90% of patients, although this is often asymptomatic.[3,6]

In patients with symptomatic medial epicondyle nonunions, pain and valgus instability may require surgical intervention. Surgical options include open reduction and internal fixation (ORIF) with screws or fragment excision and medial ulnar collateral ligament (MUCL) reconstruction or repair.[4,9,11] While success with these techniques have been reported, persistent nonunion may still occur.[9,12] Literature discussing the management of a failed medial epicondyle nonunion surgery is limited, with one case report demonstrating a successful outcomes with fragment excision and MUCL repair and a second showing a successful outcome with a closing wedge varus corrective osteotomy of the distal humerus.[4,10]

In this case report, we present the successful management of a failed medial epicondyle nonunion ORIF with revision ORIF using interposition distal clavicle autograft and preservation of the medial epicondyle and MUCL. The patient was informed that data concerning their case would be submitted for publication, and she provided consent.

Case report

A 19-year-old female presented with left elbow pain five days following a fall while skiing. Her chief complaint was medial elbow pain with ulnar nerve paresthesias. She reported a prior medial epicondyle fracture sustained at age 12 that was

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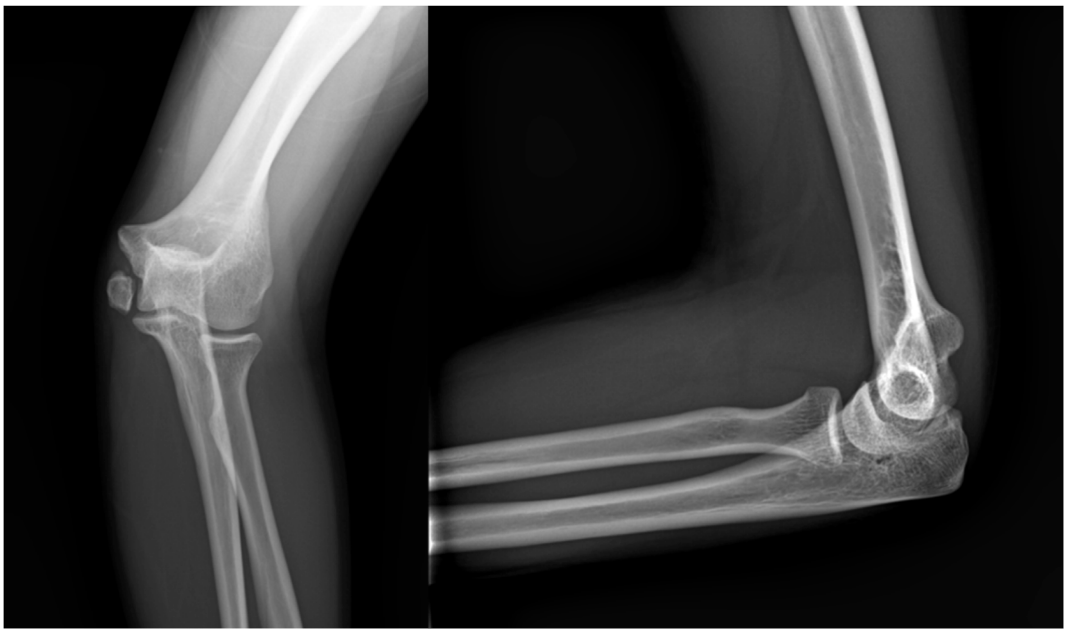

Figure 1 – An AP and lateral radiograph of the left elbow demonstrating a distally displaced medial epicondyle with sclerosis at the fracture site, consistent with a previous nonunion. *AP*, anteroposterior.

treated nonoperatively and ultimately went on to an asymptomatic nonunion.

On physical examination, the patient had substantial medial elbow ecchymosis and pain to palpation along the medial elbow. She noted diminished ulnar nerve sensation to light touch with a positive Tinel sign along the cubital tunnel. She had discomfort with milking maneuver as well as with valgus stress test. Radiographs (Fig. 1) obtained at this time demonstrated a displaced medial epicondyle nonunion.

After discussion with the patient, she elected to proceed with ORIF of her medial epicondyle nonunion and ulnar nerve subcutaneous transposition. At the time of surgery, the medial epicondyle fracture demonstrated minimal mobilization secondary to contracture and shortening of the MUCL. Despite this, the fracture fragment was mobilized as extensively as possible and secured with a single 4.0-mm cannulated screw, suture anchor, and allograft (Fig. 2). The anchor was placed distal to the medial epicondyle, with sutures fixating into the MUCL. Synthetic bone substitute allograft composed primarily of beta-tricalcium phosphate was placed at the fracture site. Post-operatively, she was secured in a posterior mold splint at 90° of flexion for two weeks before transitioning to a hinge elbow brace that allowed for progressive extension. Despite this, at her 3-month post-operative follow-up, the patient reported increasing pain and radiographs demonstrated loss of fixation without medial epicondyle radiographic healing (Fig. 3). Failure of her surgery was thought to be due to chronic shortening of her MUCL, which limited fracture mobility and adequate medial epicondyle reduction, leading to mechanical failure. After discussion with the patient, she elected to proceed with a revision medial epicondyle nonunion ORIF and distal clavicle autograft interposition. The patient elected to proceed with distal clavicle autograft in order to avoid the donor site morbidity that can be associated with iliac crest autograft.

At the time of the revision surgery, a maximal amount of distal clavicle was harvested without risking destabilization of the acromioclavicular joint. The graft was then shaped to match to fracture bed with the final graft measuring 7 millimeters (mm) in width and 20 mm in length (Fig. 4). The distal clavicle was prepared with cartilage and soft-tissue removal and burring to create a bleeding cancellous surface. Her prior medial elbow incision was utilized to expose the medial epicondyle nonunion and remove the previously placed cannulated screw. The nonunion fracture fragment and fracture bed were meticulously cleared of all scar and fibrinous tissue (Fig. 5) with sharp dissection and a 4-mm burr. The flexor–pronator mass and the contracted MUCL were preserved with its attachment to the medial epicondyle. The distal clavicle autograft was then interposed between the fracture bed and the medial epicondyle, which created bone-to-bone contact without release of the MUCL. The graft and fracture fragment were then fixed with one 4.0mm cannulated screw oriented into the lateral column and one 3.0-mm cannulated screw oriented parallel to the joint (Figs. 6 and 7). Intraoperatively, excellent screw purchase and graft and fragment stability was achieved. Post-operatively, the patient was immobilized in a posterior mold splint at 90° of flexion for two weeks before transitioning to a hinge elbow brace allowing for progressive extension. While in the hinged elbow brace, the patient was initially limited to 60° of extension and gradually progressed to full extension by 6 weeks post-operatively. She maintained a five-pound weight-bearing restriction until confirmation of complete osseous union.

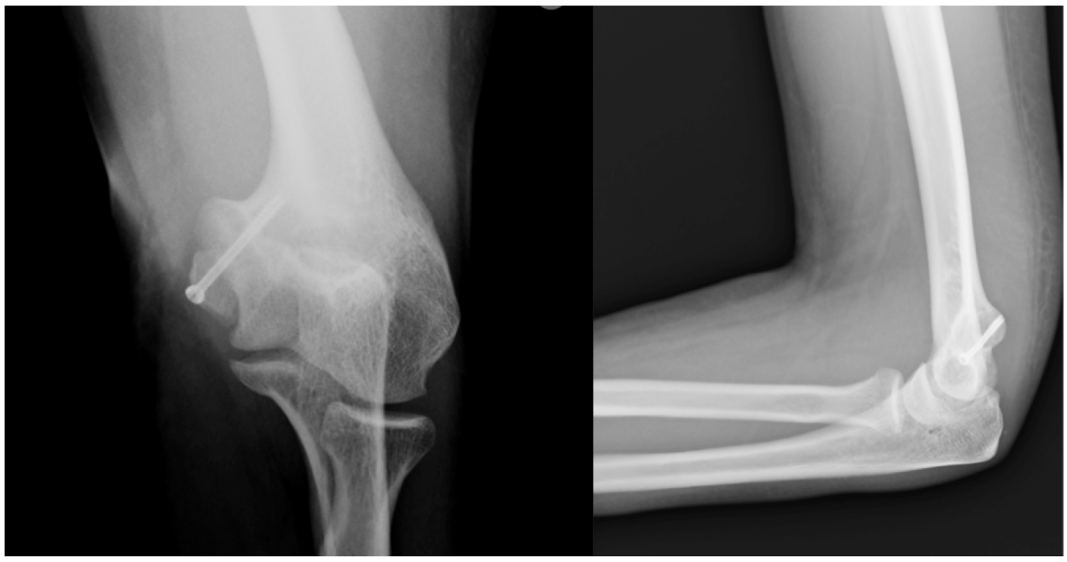

Figure 2 – An AP and lateral radiograph demonstrating initial postoperative imaging following open reduction and internal fixation of medial epicondyle nonunion. *AP*, anteroposterior.

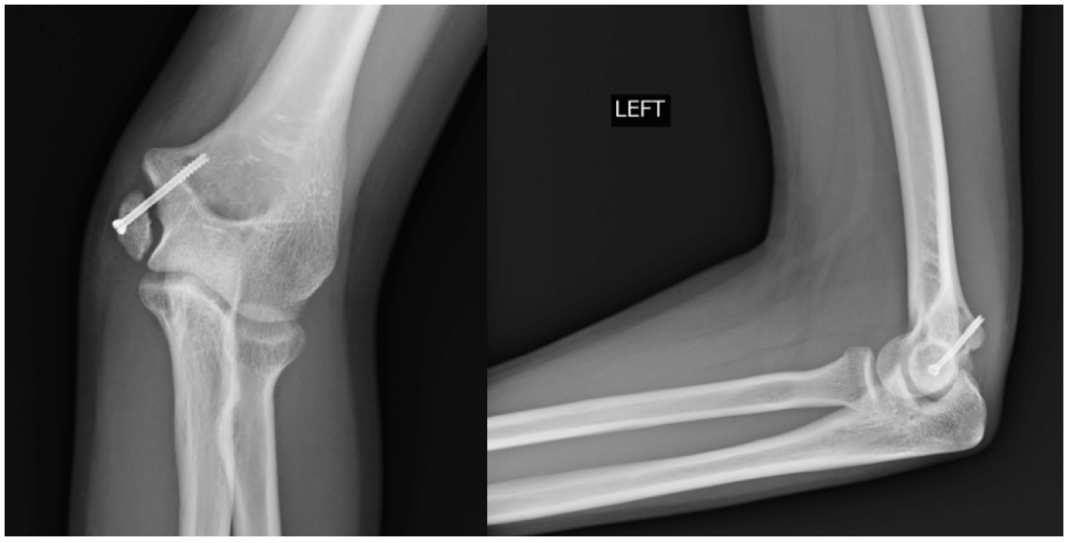

Figure 3 – An AP and lateral radiograph demonstrating persistent medial epicondyle nonunion with increased fracture gap and no interval callus formation at 3 months postoperatively. *AP*, anteroposterior.

At 8 weeks post-operatively, the patient was clinically improving and there was radiographic healing between the distal clavicle autograft and medial epicondyle as well as early callus formation between the distal clavicle autograft and distal humerus fracture bed (Fig. 8). A computer tomography scan at 10 months demonstrated complete osseous union (Fig. 9). The patient subsequently underwent removal of her screws due to a symptomatic screw head and returned for final radiographs at 14- months, which demonstrated complete radiographic healing following screw removal (Fig. 10). Clinically, she returned to work as a veterinary tech and maintained an extension–flexion arc of 0°-140° along with full pronation and supination (Fig. 11).

Discussion

Failure of medial epicondyle nonunion surgery is rare; however, the management of this complication is under-reported in the literature. In this case report, we present a successful revision ORIF using an interposition distal clavicle autograft, with preservation of the medial epicondyle and MUCL. We

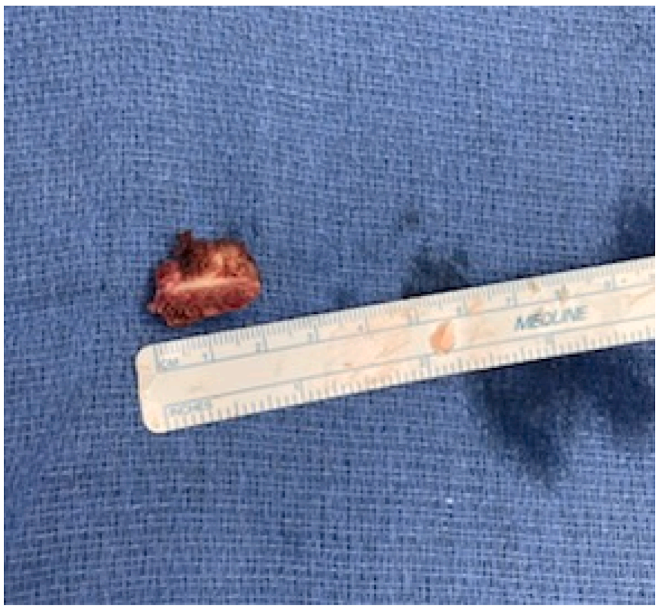

Figure 4 – A clinical photo of the distal clavicle autograft, measuring 20 mm in length.

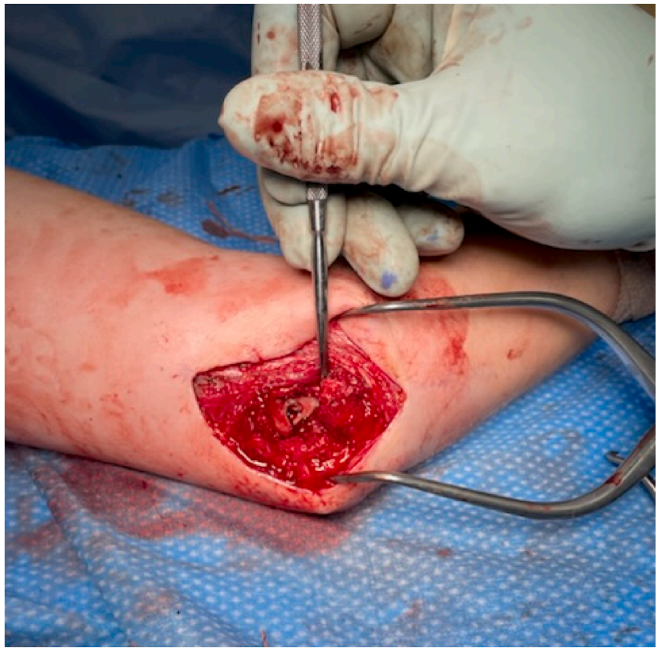

Figure 5 – An intraoperative photo demonstrating the distal humerus fracture bed after removal of the cannulated screw and soft tissue.

believe the main advantages of this technique include preservation of the MUCL and the flexor–pronator mass, as well as the ability to achieve bone-to-bone healing at the previously failed nonunion site.

Medial epicondyle nonunions are relatively common. In one of the largest series published, Farsetti et al[5] found that nonunions occurred in 89% of patients treated nonoperatively, while a large systematic review reported a 50% nonunion rate with nonoperative management.[6] Despite high nonunion rates, only 21% of nonunions are symptomatic.[12] When symptomatic, ORIF of medial epicondyle nonunions has reported union rates near 90%.[9,12] Fragment excision with MUCL repair or reconstruction has also been reported as a successful treatment option in patients with medial epicondyle nonunions.[4,7] Despite this, failure

Figure 6 – An intraoperative photo demonstrating fixation of the medial epicondyle with 2 cannulated screws.

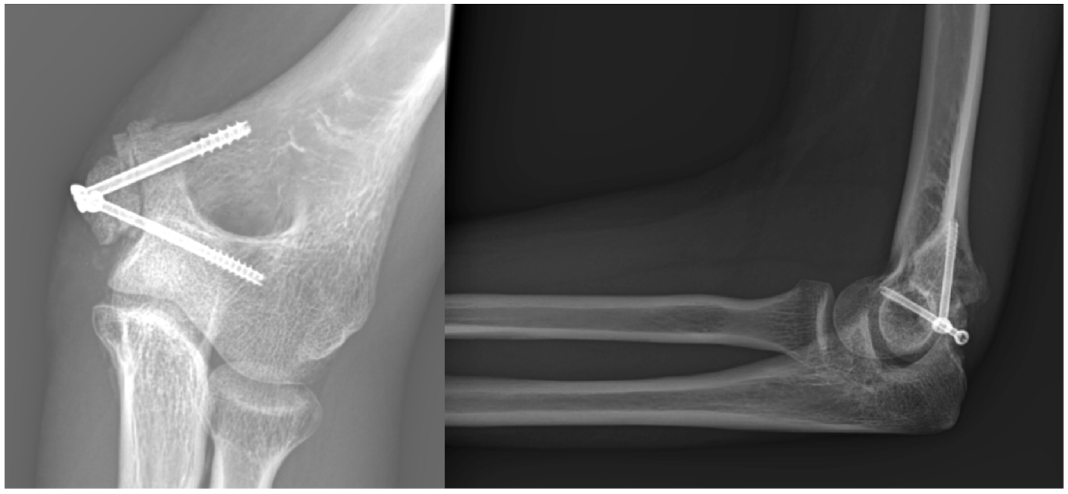

Figure 7 – An AP and lateral radiograph with interposition of the distal clavicle autograft and bone-to-bone contact of the medial epicondyle fragment and distal humerus fracture bed. *AP*, anteroposterior.

of medial epicondyle nonunion surgery occurs, and very few revision techniques have been described.

Two case reports have reported on the management of a previously failed medial epicondyle nonunion surgery.[4,10] In their case series of 5 patients with valgus instability due to medial epicondyle nonunion, Gilchrist and McKee[4] reported on 2 patients who had previously failed medial epicondyle nonunion ORIF. These patients were managed with medial epicondyle nonunion fragment excision and MUCL advancement and repair to the distal humerus. They reported successful outcomes with Mayo Elbow Performance Scores improving from preoperative values of 60 and 65 to 90 and 90 at 30 and 14 months post-operatively, respectively. No significant changes in range of motion were noted.

Lie et al[10] reported on a case of a 13-year-old patient with Rubinstein–Taybi syndrome, who presented with a hypoplastic elbow joint and a nonunion avulsion fracture of the medial epicondyle resulting in valgus instability. The patient was initially treated with fragment excision and MUCL reconstruction using a peroneus longus allograft. Initial elbow stability was reported; however, recurrence of valgus instability was noted at 2 years postoperatively. Definitive

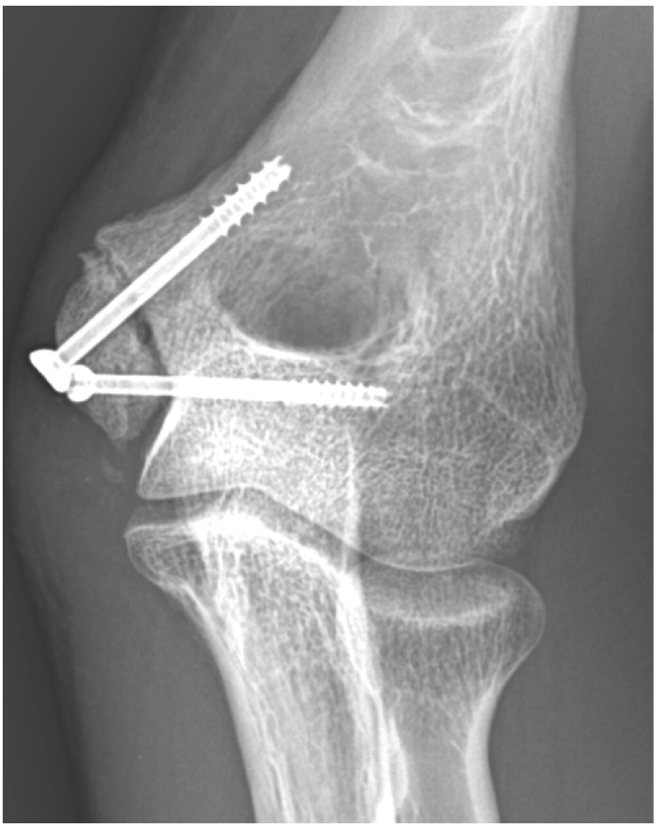

Figure 8 – An AP radiograph at 8 weeks postoperatively demonstrating healing of the distal clavicle autograft to the medial epicondyle fragment. Early callus formation between the distal clavicle autograft and distal humerus fracture bed is noted. *AP*, anteroposterior.

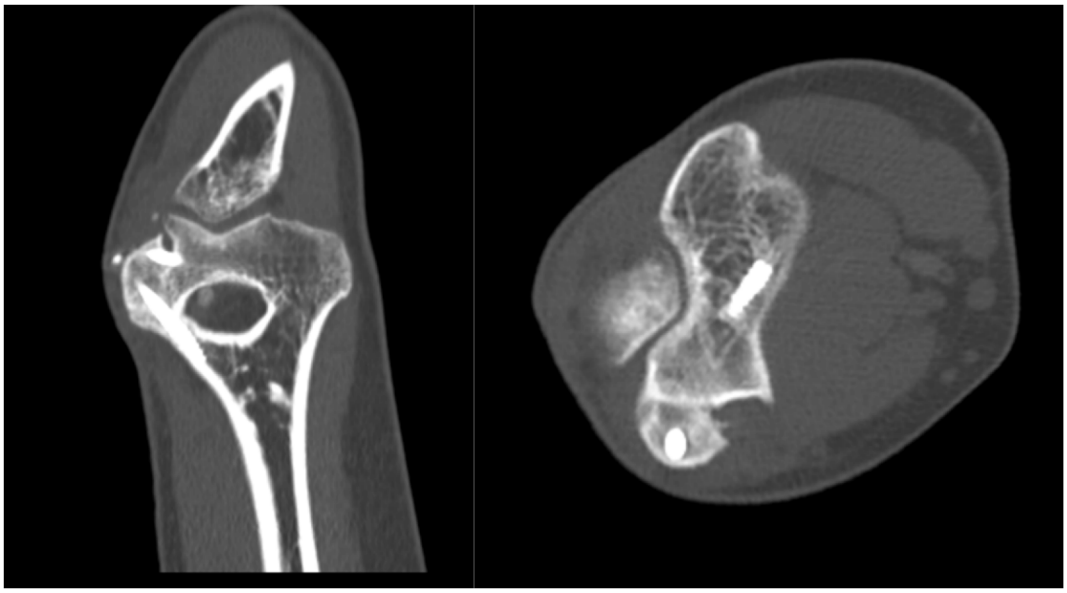

Figure 9 – Select coronal and axial CT cuts demonstrate fracture union at 10 months postoperatively. *CT*, computed tomography.

Figure 10 – An AP and lateral radiograph demonstrating fracture union at 12 months postoperatively. Note previous cannulated screws have been removed. *AP*, anteroposterior.

Figure 11 – Clinical photos of the patient demonstrating full extension and flexion of the elbow as well as full pronation and supination of the forearm.

treatment included a supracondylar osteotomy with a 30° correction. At the 10-year follow-up, the patient was found to have an acceptable outcome with 0°-120° extension–flexion arc of motion. While this case reports successful management of a previously failed medical epicondyle nonunion surgery, it also illustrates the risks of recurrent instability associated with fragment excision and ligament reconstruction. We believe the preservation of the MUCL in our described technique can result in a lower risk of recurrent instability seen with fragment excision and ligament reconstruction.

Distal clavicle autograft provides several benefits; it has low donor-site morbidity, is locally available to the elbow surgical site, and is a robust corticocancellous graft. Compared to other common graft options, distal clavicle is more cost-effective than allograft options and is locally available for efficient harvesting. Other common corticocancellous autograft options, such as iliac crest autograft, have higher donor-site morbidity, while distal clavicle autograft has low donor-site morbidity.[8,13] Lastly, corticocancellous grafts are favorable as they provide osteoinductive, osteoconductive, and osteogenic properties.[8] Potential disadvantages of distal clavicle autograft include iatrogenic destabilization of the acromioclavicular joint, donor-site pain, hypertrophic scar, or infection. In addition, distal clavicle autograft may not be a suitable option if large quantities of autograft are needed.

Conclusion

This case demonstrates the successful management of a failed medial epicondyle nonunion ORIF with revision ORIF using an interposition distal clavicle autograft with preservation of the medial epicondyle and MUCL.

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Patient consent: Obtained.

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