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Recurrent tardy ulnar collateral ligament insufficiency due to cubitus valgus: management with concomitant osteotomy and dual cortical button suspension technique

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Ulnar collateral ligament (UCL) reconstruction was first attempted by Jobe et al,[8] with fair results in professional pitchers. High rates of neurapraxia and the risk of epicondyle fracture with the Jobe figure-of-8 technique spawned a muscle-splitting approach and the more recent docking technique, both of which have become the current standard of care and demonstrate excellent clinical success.[3,18,19,22] These are the most widely used surgical techniques, but several alternative procedures have been described, including interference screw fixation, a hybrid technique, and the David Altchek and Neal ElAttrache for Tommy John (DANE TJ) techniques.[5] Recently, cortical button fixation has shown comparable biomechanical success to traditional techniques on the ulnar side, providing a good option in revision situations with bone loss.[1,7,12-14]

In this case report, we describe the management of a young adult presenting with post-traumatic cubitus valgus with tardy, recurrent, UCL insufficiency, and ulnar neuropathy. The patient also presented with severe medial epicondyle bone loss, precluding the standard docking fixation. This case is unique in that it required a concomitant distal humerus varus-producing osteotomy coupled with a modified revision UCL reconstruction technique using dual cortical button suspension fixation on the humeral and the ulnar sides.

Case report

A 29-year-old right hand–dominant woman presented with progressive right elbow valgus instability. She reported a history significant for a medial epicondyle fracture at age 12 treated surgically with 3 pins. She subsequently underwent a UCL reconstruction at age 19 for symptomatic UCL insufficiency, which was performed by an outside surgeon. This reconstruction attenuated and required revision by the same surgeon 2 years later. After the second procedure, she complained of persistent pain and discomfort. In 2011, a recurrent acute event occurred while she was forcefully shutting a gate, at which point she presented to our clinic complaining of increased medial elbow pain and subjective instability.

Physical examination revealed a healed medial incision with tenderness in the cubital tunnel, sublime tubercle, and flexor pronator mass. She had a negative Tinel sign and no evidence of ulnar nerve subluxation. There was mild pain with valgus stress in 30° of flexion and a positive moving valgus stress test. She had full range of motion, grade 3 valgus instability, and a high carrying angle clinically. Radiographs revealed signs of chronic valgus extension overload with posteromedial ulnohumeral osteophytes and a carrying angle of 28° (Fig. 1).

In summary, this patient presented with recurrent tardy UCL insufficiency which was felt to be secondary to post-traumatic cubitus valgus. Given the degree of functional disability, the patient elected for operative intervention. At the age of 30, she underwent a combined 7.5-mm medial closing wedge, varus-producing, supracondylar osteotomy, ulnar nerve subcutaneous transposition, and revision UCL reconstruction with autogenous hamstring tendon (Figs. 2 and 3). Given the degree of medial epicondyle bone loss, the traditional docking technique,[18] was not possible. We therefore performed a modified UCL reconstruction with ipsilateral gracilis autograft using far cortical button fixation on the ulnar and humeral sides.

Briefly, the patient was positioned supine with the arm placed on a radiolucent arm board. The arm and donor site were prepared and draped. The distal humerus was approached using the

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Figure 1 Anteroposterior view of the right elbow displays signs of chronic valgus extension overload with posteromedial ulnohumeral osteophytes and a carrying angle measuring 28°.

Figure 3 Intraoperative x-ray image demonstrates the insertion of a second Kirschner wire in preparation for a 7.5-mm closing wedge osteotomy of the distal humerus. Once both Kirschner wires were inserted, a microsagittal saw was used to cut along the Kirschner wires while keeping the lateral cortex and periosteum intact.

existing posteromedial incision. Care was taken to preserve branches of the medial antebrachial cutaneous nerve. The ulnar nerve was identified and dissected to the Arcade of Struthers proximally and to the first motor branch to the flexor carpi ulnaris distally. The retained suture material and graft were resected from prior failed operations. No epicondyle remained. Soft tissues, including the flexor pronator mass, were elevated subperiosteally anteriorly.

Based on preoperative planning, a closing wedge osteotomy was performed above the olecranon fossa. Kirschner wires were drilled parallel to the joint line distally and angled proximally to remove 7.5 mm of bone to optimize her carrying angle. Next, a microsagittal saw was used to cut along the Kirschner wires, with care taken to avoid violating the lateral humeral cortex. A medial column plate was used to secure the osteotomy as the wedge was closed. Before screws were placed, the humeral and ulnar tunnels of the UCL reconstruction were drilled, as described below, and reamers were left in place to prevent screws from the plate interfering with graft passage. An anterior antiglide plate was subsequently placed along the anterior cortex to increase osteotomy fixation.

The gracilis autograft was harvested and doubled, and then sutured at either end with high-tensile nonabsorbable sutures, creating a 4- to 5-mm graft. A cortical button was positioned onto the sutures at either end. The sublime tubercle was identified, and a spade-tip guide pin was advanced bicortically under fluoroscopic guidance, aiming distal and dorsal to the proximal radioulnar joint. A cannulated reamer matching the size of the graft (4-4.5 mm) was drilled unicortically to a depth of approximately 15 mm. The graft was docked distally and advanced into the ulna. Next, the humeral isometric point was identified, and the guide pin was placed across the spool of the distal humerus bicortically, aiming at the lateral epicondyle.

In primary reconstructions we identify the isometric point at the junction between the medial epicondyle and the medial edge of the trochlea, but the native isometric point was compromised in this revisions case. We therefore used a true lateral radiograph to identify the center of the capitellum. The guide pin was placed at this location. We confirmed isometry by running a suture from the ulnar tunnel to this guide pin. Consistent tension within the suture throughout the arc of flexion and extension was noted, ensuring appropriate location.

A cannulated reamer was used to drill a 30-mm-deep humeral tunnel, into which 20 mm of graft was inserted. The reamers were removed, and the second cortical button was advanced bicortically. The elbow was placed in 15° to 20° of flexion with a slight varus force by placing a bump under the lateral wrist. The graft was reduced into the tunnel and tensioned. Humeral and ulnar sutures were passed through the graft in a running, locking fashion that incorporated the underlying native UCL. Once the sutures were passed through the graft on the humeral and ulnar sides, they were tied at each end. A subcutaneous ulnar nerve transposition was completed using an anteriorly based flap of Scarpa's fascia. The tourniquet was released and meticulous hemostasis obtained before closure and the placement of bandages.

Figure 2 Intraoperative x-ray image demonstrates the insertion of the first Kirschner wire parallel to the joint in preparation for a 7.5-mm closing wedge osteotomy of the distal humerus. Valgus stress reveals medial joint gapping indicative of complete ulnar collateral ligament insufficiency.

Figure 4 Anteroposterior view of the right elbow demonstrates dual plating. Far cortical suture button fixation is seen along the lateral epicondyle and distal to the radioulnar joint. A neutral carrying angle has been obtained.

Figure 5 Lateral view of the right elbow demonstrates satisfactory alignment and fixation with precontoured distal humerus plates. Far cortical suture button fixation is seen just anterior to the lateral epicondyle and distal to the proximal radioulnar joint.

The patient was placed in a posterior splint for the initial 5 days postoperatively and instructed on elevation for edema control and wound healing. The patient was then placed in a soft, compressive dressing to help with swelling and a sling. No brace was used. Sling use was continued for 4 weeks continuously and for an additional 2 weeks whenever the patient was outside of the home. During the initial 4 weeks after surgery, active assisted range of motion using the contralateral hand was initiated for flexion and extension. Pronation and supination were performed while in the sling. Very limited formal physical therapy was used to help the patient regain full terminal elbow extension through static-progressive stretching. At 3 months postoperatively, unrestricted activity was permitted.

At 6 years of follow-up, the patient continues to have no subjective or objective instability. The osteotomy is healed with a neutral carrying angle. She has a range of motion of 0° to 140° in the sagittal plane with a full 180° pronation supination arc (Figs. 4 and 5). She has good function, with a Single Assessment Numeric Evaluation score of 75 and Mayo Elbow Performance Score of 95. Her Disabilities of the Arm, Shoulder and Hand score is 23.3, but the score is limited by intermittent ulnar nerve symptoms and mild elbow pain with deep flexion. The patient reported a visual analog scale pain score of 0 at rest and has returned to all activities and her chosen occupation of nursing without limitations. She denies symptomatic hardware and is extremely satisfied with her elbow. Her only complaints are mild ulnar nerve numbness and mild elbow pain upon deep flexion without objective or subjective weakness.

Discussion

The young adult we describe in this case presented with post-traumatic cubitus valgus resulting in tardy UCL insufficiency and ulnar neuropathy. This uncorrected cubitus valgus predisposed the patient to 2 failed UCL reconstructions. This unique case provided the impetus for a modified UCL reconstruction technique using dual far cortical button suspension fixation on the humerus and the ulna in combination with a closing wedge varus-producing supracondylar osteotomy.

The medial epicondyle is the origin of the flexor-pronator mass and the UCL, which maintain dynamic and static restraint, respectively. A valgus carrying angle averaging approximately 18° allows the distal extremity to clear the pelvis while walking with the elbows extended. Although both are rare with current surgical trends, cubitus varus deformity is far more common than cubitus valgus deformity after pediatric physeal injuries. Cubitus varus is known to result in tardy ulnar nerve palsy.

Less familiar to many surgeons, cubitus varus is associated with delayed posterolateral rotatory instability. O'Driscoll et al[16] described 25 such cases. They proposed a causal relationship between the deformity and instability that is initiated when the triceps creates a medialized line of pull and results in rotational forces on the elbow that ultimately lead to lateral UCL attenuation and failure.[16] Supporting this hypothesis, Beuerlein et al[4] demonstrated increased forces on the lateral UCL with cubitus varus in vivo. Both of these can benefit from valgus-producing osteotomies.[10,11,16,17,20]

To our knowledge, this is the first description of an analogous tardy, recurrent, UCL insufficiency secondary to neglected cubitus valgus. Our case is a rare report of symptomatic cubitus valgus after a medial epicondyle physeal injury because it is typically associated with lateral condylar fractures due to lateral growth plate arrest.[21] Like cubitus varus, cubitus valgus has also been associated with tardy ulnar nerve palsy. Kang et al[9] reported outcomes of concomitant varus-producing osteotomies and ulnar nerve transposition for tardy ulnar nerve palsy after lateral condyle fractures, with 12 of 13 patients achieving ulnar nerve symptom resolution.

Analogous to the description by O'Driscoll et al[16] of tardy posterolateral rotatory instability, this patient's excessive cubitus valgus biomechanically predisposed her to UCL pathology. The sports medicine literature has reliably demonstrated that genu varus is a modifiable risk factor for failure of posterolateral corner reconstruction.[2] Similarly, this patient's cubitus valgus deformity predisposed her to the failure of 2 prior UCL reconstructions. Durable, good results were provided with revision UCL reconstruction protected with a concomitant varus-producing distal humerus osteotomy using a dual cortical button suspension technique.

Conclusions

We present a case of recurrent, functionally symptomatic UCL insufficiency secondary to post-traumatic cubitus valgus. Medial epicondyle bone loss precluded the standard docking fixation, spawning a dual far cortical button suspension technique for UCL reconstruction. The patient achieved a favorable result through 6 years of follow-up. We have since performed this reconstruction technique in 40 primary UCL reconstructions in throwing athletes,[15] with results comparable to the current literature.[6]

Disclaimer

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