Surgical Technique: Medial Ulnar Collateral Ligament Reconstruction Using Hamstring Allograft

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Introduction

In the overhead throwing athlete, medial ulnar collateral ligament reconstruction utilizing a hamstring allograft as an alternative to an autograft provides similar results without the donor site morbidity or potential complications of autograft harvest. Historically, several graft options have been utilized and described for medial ulnar collateral ligament reconstruction, including the palmaris longus, gracilis, plantaris, toe extensors, and Achilles tendon. Waris originally described injury to the medial ulnar collateral ligament in 1946¹, and Jobe performed the first successful reconstruction² in 1974. The original technique was performed with use of the ipsilateral palmaris longus.

Injuries to the medial ulnar collateral ligament have become increasingly more common³. This injury has traditionally been seen in overhead throwing athletes (baseball and softball players, and javelin throwers)⁴. Increased valgus stress at the elbow seen with overhead activities predisposes these athletes to medial-sided elbow injuries, including rupture or tearing of the medial ulnar collateral ligament. These injuries have been known to occur acutely, with a single pitch, and as overuse injuries over time. Patients often complain of decreased velocity and accuracy as well as pain and instability with the late cocking and early acceleration phases of throwing.

Physical examination typically shows some degree of valgus laxity at the elbow and a positive moving valgus extension overload test. Radiographic examination may reveal stress-related changes such as medial spurring of the olecranon tip or olecranon fossa. Magnetic resonance imaging (MRI) or magnetic resonance arthrography (MRA) typically provides a good view of the medial ulnar collateral ligament and will show both partial tearing and complete disruption of the ligament.

The most important aspect of the surgical reconstruction of the medial ulnar collateral ligament is anatomic tunnel placement to recreate the anatomic valgus restraint of the ligament. Reconstruction of the medial ulnar collateral ligament using a hamstring allograft eliminates donor site complications related to graft harvest. The rate of donor site complications has been reported to be high as 25% and to range from superficial infection, scarring, or cutaneous tenderness to accidental harvest of the median nerve.

Step 1: MRI or MRA and Preoperative Planning

Obtain an MRI or MRA to determine the location and importance of the tear in the ligament.

- Radiographs should be obtained to look for any degenerative or osseous changes, and to evaluate the osseous alignment of the arm and forearm.
- An MRI or MRA will allow you to identify the tear's location (humeral avulsion, ulnar avulsion, or mid-substance) and severity (complete or partial) (Fig. 1).
- Check the availability of gracilis allograft. (The semitendinosus can be used as a backup.)
- During the surgery, with the patient under anesthesia, evaluate the range of motion and the degree of instability and check the contralateral elbow for comparison.
- As the first surgical step, perform diagnostic arthroscopy to confirm the instability and help identify any intra-articular pathology.

Step 2: Medial Elbow Dissection and Identification of the Medial Ulnar Collateral Ligament (Video 1)

Position the elbow to allow access to the medial side, and expose the medial ulnar collateral ligament via a flexor-pronator split approach.

- Rotate the shoulder and lay the arm on the arm board, exposing the medial aspect of the elbow (Fig. 2-A).
- Make an approximately 6-cm incision from the posterior aspect of the proximal tip of the medial epicondyle and extend it distally past the location of the sublime tubercle (Fig. 2-B).
- Perform blunt dissection and identify the medial antebrachial cutaneous nerve. Expose and protect the ulnar nerve without transposition unless indicated by the preoperative evaluation.
- Sharply incise the flexor-pronator fascia between its middle and posterior bands and then divide the underlying muscle longitudinally without detaching the muscle from the epicondyle (Smith approach) (Fig. 2-C and Video 2).
- Identify the medial ulnar collateral ligament overlying the ulnohumeral articulation. Confirm the tear and the necessity for reconstruction rather than repair. Identify the sublime tubercle (Fig. 2-D).
- Make a longitudinal incision at the anterior aspect of the ligament, and reflect the remnants of the native medial ulnar collateral ligament posteriorly off of the sublime tubercle and the medial epicondyle to reveal the anatomic origin and insertion of the ligament (Fig. 2-E).

Step 3: Preparation of Hamstring Allograft

Prepare the non-irradiated hamstring allograft by placing lead Krackow stitches into each end, and if necessary suture it in the middle to help with passage through the bone tunnels.

- The allograft should be thawed and the ends should be trimmed.
- Keep the graft long to provide adequate length, but the leftover graft can be doubled over after passage through the humeral tunnel to provide increased bulk to the graft or incised.
- Whipstitch both ends of the allograft to help facilitate graft passage through the drilled tunnels.
- Size the graft.

Step 4: Ulnar-Sided Reconstruction

Use a single-hole technique, inserting a Beath pin into the sublime tubercle to allow a single screw to fix the graft into the ulna, OR use a double-hole technique, making connecting drill holes under the sublime tubercle and passing the graft through the tunnels.

- Identify the sublime tubercle approximately 3 mm distal to the ulnohumeral joint (Video 3).
- Drill a guide pin directly into the sublime tubercle unicortically, remove the pin, and place it back into the same hole while changing the angle to direct the pin distally and posteriorly away from the proximal radioulnar joint. The pin will therefore go from the sublime tubercle bicortically through the proximal part of the ulna (Fig. 3). Alternatively, use a standard Jobe technique with interconnecting drill holes (Video 3).
- Ream the proximal aspect of the ulnar tunnel unicortically over the guide pin using a 5.0-mm reamer.
- Place an absorbable suture in the middle of the graft. Use the Beath pin to pull the suture into the tunnel and out of the radial side of the ulna. Then use the suture to pull the doubled graft into the tunnel until it hits the opposite cortex.
- Insert a tenodesis screw (4.75 or 5 mm) to create an interference fit with the graft at the exact isometric point of the sublime tubercle.

Step 5: Humeral-Sided Reconstruction

Place a single drill hole into the center of the origin of the medial ulnar collateral ligament at the distal end of the medial epicondyle; place two connecting tunnels and shuttle the graft ends through these tunnels.

- Identify the proximal insertion site of the medial ulnar collateral ligament at the distal part of the anterior aspect of the humeral epicondyle (Fig. 4-A) (Video 4).
- Use a 4.5 or 5-mm reamer to drill the humeral tunnel from the exact origin point of the medial ulnar collateral ligament into the medial epicondyle from anterior to posterior (Fig. 4-B) (Video 5).
- Drill two connecting tunnels, usually 2.5 to 3 mm in diameter, from the medial posterior epicondyle to connect to the central tunnel. Then pull each limb of the graft through the central humeral tunnel and out of one of the two branch tunnels (Fig. 4-C).
- If there is enough length, the graft may be doubled back into the opposite tunnel and through the central tunnel to reinforce the ligament reconstruction, leaving three strands between

the humerus and ulna. The grafts are tensioned while the elbow is cycled to eliminate laxity⁵ (Fig. 4-D).

Step 6: Graft Fixation and Ligament Repair (Video 6)

Tension the graft while the elbow is placed through a full arc of motion, suture the two limbs of the graft together, and suture the medial ulnar collateral ligament to the graft.

- Tension the graft, place the arm in 70° of flexion and the forearm in supination, and suture the two limbs of the graft to each other and to the fascia of the medial epicondyle with a number-5 Ethibond suture (Ethicon, Cornelia, Georgia) or a number-1 Vicryl suture (Ethicon), or both. The Vicryl will also be used to suture the grafts to the most proximal part of the flexor pronator split (Fig. 5).
- Suture the remnant of the native ligament to the allograft with a number-1 PDS (polydioxanone) suture (Ethicon).

Step 7: Closure

Irrigate the wound, repair the flexor-pronator fascia with absorbable suture, and perform a standard subcutaneous and skin closure.

- Irrigate the wound and obtain hemostasis.
- Close the flexor-pronator fascia using an absorbable suture.
- Then perform a standard subcutaneous and skin closure.
- Apply a protective plaster splint with a sling. This is swapped for a hinged elbow brace at the first postoperative visit.

Results

Medial ulnar collateral ligament reconstruction utilizing a hamstring allograft instead of an autograft has so far produced excellent results. Of the 116 patients in our original study, 110 returned to play⁶. Three of the six patients who did not return to play stated that their reason was unrelated to the elbow. The average time until a structured “return to pitch” program was started was 5.5 months, and the average time to return to competition was 9.5 months. Ninety-seven (84%) of the 116 patients

stated, at the time of the last follow-up, that they were competing at or above their previous level of competition. There were no clinical failures or revisions.

What to Watch For

Indications

- Failure of nonoperative treatment, including rest, bracing, nonsteroidal anti-inflammatory drugs, and rehabilitation.
- Inability to resume play due to elbow dysfunction.
- Desire to return to play.

Contraindications

- Level of play not affected by injury.
- No desire to return to play.
- Concurrent infection.
- Patient noncompliance.

Pitfalls & Challenges

- Identification of damaged ligaments that do not need reconstruction can be difficult; some ligaments, such as those avulsed off of the humeral insertion, may be amenable to repair. Some partially torn ligaments may be treated nonoperatively with bracing, rehabilitation, and rest.
- Anatomic placement of both the ulnar and the humeral tunnel can be difficult.
 - » The ulnar tunnel is close to the ulnohumeral joint, and the joint must be protected.
 - » Humeral tunnel placement results in a stress riser in the medial epicondyle and is at risk for fracture (a known complication).
- The medial antebrachial cutaneous nerve must be identified and protected. The ulnar nerve is also close and should be protected when the surgeon is drilling the humeral tunnel.

Clinical Comments

- What are your concerns about the use of allograft in terms of healing potential and time to graft incorporation?
- What measure might be taken during drilling of the humeral tunnel to help prevent medial epicondyle fracture?

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Figures

Fig. 1
MRI of a severely damaged medial ulnar collateral ligament in a throwing athlete.

Fig. 2-A
Right arm on an arm board with the patient prone. The incision is marked with a dotted line, and the ulnar nerve path is marked with a straight line.

Fig. 2-B
Incision from the posterior aspect of the proximal tip of the medial epicondyle extending distally past the location of the sublime tubercle.

Fig. 2-C
Split flexor-pronator mass.

Fig. 2-D
Sublime tubercle illustrated with a dot.

Fig. 2-E
Medial ulnar collateral ligament remnants split, and ulnohumeral joint identified. The yellow and white arrows demonstrate the areas of damage to the ligament.

Fig. 3
Guide pin drilled through the ulna at the sublime tubercle.

Fig. 4-A
Proximal insertion site.

Fig. 4-B
Humeral tunnel drilled from the exact origin point of the medial ulnar collateral ligament anterior to posterior into the medial epicondyle.

Fig. 4-C
Each limb of the graft is pulled through the central humeral tunnel and out one of the two connecting tunnels.

Fig. 4-D
Final graft tensioned and fixed.

Fig. 5
Completed repair.

Fig. 1

Fig. 2-A

Fig. 2-B

Fig. 2-C

Fig. 2-D

Fig. 2-E

Fig. 3

Fig. 4-A

Fig. 4-B

Fig. 4-C

Fig. 4-D

Fig. 5