

Suture Button Repair for Lateral Ulnar Collateral Ligament in Terrible Triad Injuries: Surgical Technique



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Abstract: Terrible triad injuries are typically treated surgically to restore elbow stability, as the radial head acts as a secondary stabilizer to valgus stress, while the coronoid provides stability against posterior elbow dislocations. The lateral ulnar collateral ligament (LUCL) is also commonly injured in terrible triad of the elbow injuries, and if not repaired, leads to posterolateral rotatory instability. Depending on the fracture pattern and size, the radial head fracture may be treated with open reduction internal fixation (ORIF), arthroplasty, or excision, whereas the coronoid fracture is most commonly treated with ORIF. If treated, these injuries are managed prior to LUCL fixation to avoid stressing the LUCL repair. We describe a technique for treatment of a LUCL injury with a suture button. When repairing the LUCL, a Kocher approach is used to visualize the LUCL footprint, which is then reattached to the insertion point on the lateral epicondyle using a suture button. The purpose of this study was to provide a step-by-step approach to using this surgical technique and an associated postoperative protocol.

Terrible triad injuries of the elbow are characterized by an elbow dislocation, radial head or neck fracture, and a coronoid fracture. These injuries are most commonly seen in male patients in the fourth and fifth decade of life after a fall onto an outstretched hand.¹ In general, structures in the elbow fail from lateral to medial.^{2,3} As such, the lateral collateral ligament complex, comprising the lateral ulnar collateral ligament (LUCL), annular ligament, and the radial collateral ligament, is the first to be disrupted, followed by the anterior capsule, and, finally, the medial collateral ligament in severe injuries.

Typically, terrible triad injuries are treated surgically as they are inherently unstable. The radial head acts as

a secondary stabilizer to valgus stress, while the coronoid provides stability against posterior elbow dislocations.¹ Open reduction internal fixation and arthroplasty are the most commonly employed for the coronoid and radial head fractures, respectively.^{2,4,5} Studies have shown that these surgical measures are important for static stability.⁶

The LUCL is thought to be the primary restraint against both varus stress and posterolateral rotatory instability (PLRI).⁶⁻⁹ As it is often avulsed from the lateral epicondyle of the humerus in these injuries, its repair is paramount in preventing long-standing instability. Treatment options include repair with suture anchors or transosseous sutures.^{4,10} Although operative fixation is the standard of care for terrible triad injuries and operative clinical outcomes are largely favorable, these injuries can be difficult to treat and patients may experience complications.¹¹⁻¹³

We present a surgical technique for repairing the LUCL with a suture button. The purpose of this study was to provide a step-by-step approach to utilizing this surgical technique and an associated postoperative protocol.^{9,11-15}

IRB Information

After Institutional Review Board approval, a single-center retrospective study of patients who underwent

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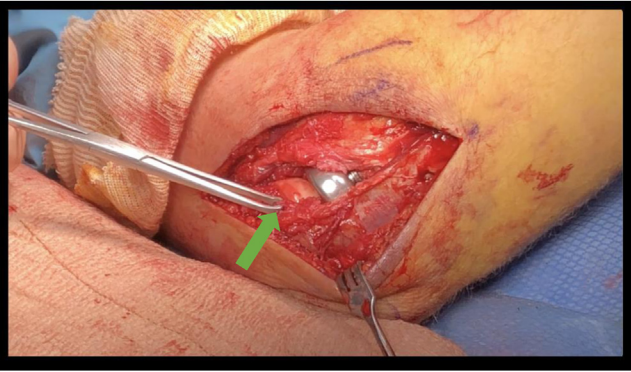


Fig 1. Patient is lying supine with right elbow flexed on a hand table and a Kocher approach to the elbow is utilized to visualize the lateral epicondyle. The LUCL is identified with an Allis clamp (also identified by green arrow). LUCL, lateral ulnar collateral ligament).

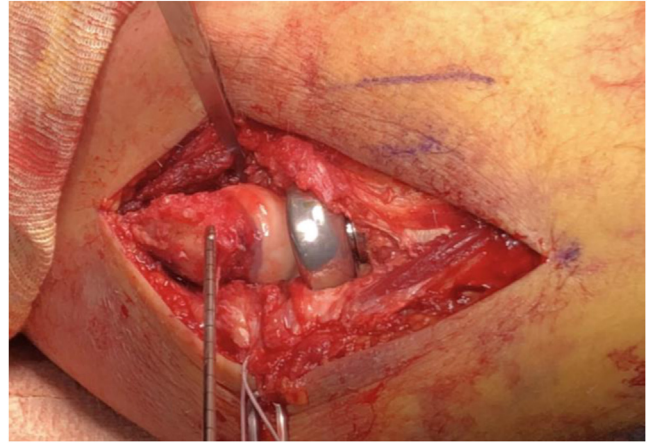


Fig 3. Patient is lying supine with right elbow flexed on a hand table, and a Kocher approach to the elbow is used to visualize the lateral epicondyle. The drill pin demonstrates the trajectory of the drill hole for the suture button, drilled from the posterior aspect of the lateral epicondyle anteriorly through the anterior cortex of the humerus. LUCL, lateral ulnar collateral ligament.

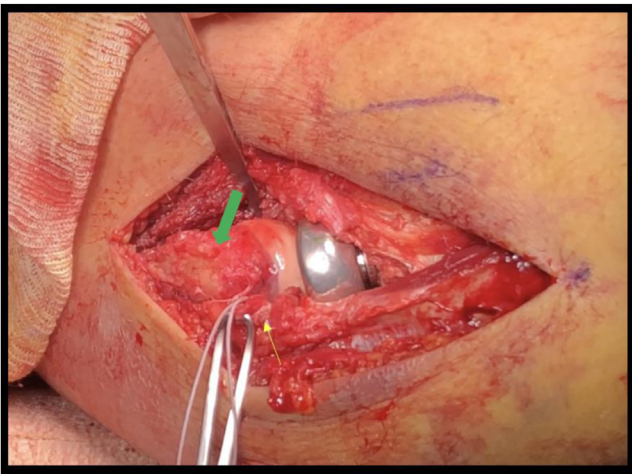


Fig 2. Patient is lying supine with right elbow flexed on a hand table, and a Kocher approach to the elbow is used to visualize the lateral epicondyle. The "bare spot" on the lateral epicondyle of the humerus indicates the origin of the LUCL (green arrow). A FiberLoop suture is placed in a locking manner through the substance of the lateral collateral ligament in preparation for drilling (yellow arrow). LUCL, lateral ulnar collateral ligament.

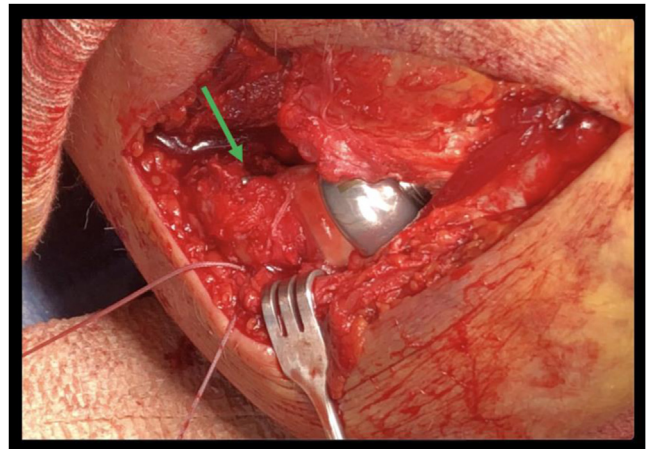


Fig 4. Patient is lying supine with right elbow flexed on a hand table and a Kocher approach to the elbow is utilized to visualize the lateral epicondyle. This image depicts the final construct of the LUCL repaired with the suture button. The green arrow indicates suture button placement on the anterolateral aspect of the humerus intraoperatively after appropriate tensioning. LUCL, lateral ulnar collateral ligament.

surgery to their elbow, which required LUCL suture button repair by one surgeon at our institution from the period including January 2015 until January 2019 was performed.

Surgical Technique

The suture button can be used for LUCL midsubstance ruptures or avulsions from the origin on the lateral epicondyle of the humerus, either as isolated injuries or in conjunction with concomitant radial head or coronoid fractures.

The patient is placed supine with a hand table, and a Kocher approach to the elbow is taken between the

ECU and anconeus muscles (see surgical technique in [Video 1](#)). The forearm should be kept in pronation during the approach to avoid injury to the posterior interosseous nerve. In patients with injury to the radial head or coronoid, these should be managed prior to LUCL fixation to avoid stressing the LUCL repair while accessing the joint to fix these other injuries.

The exposure with this approach should allow for preparation and visualization of the anatomic footprint of the LUCL origin on the lateral epicondyle of the humerus ([Figs 1 and 2](#)). The Fiberloop suture (Arthrex, Naples, FL)

Fig 5. These are the postoperative plain films, anteroposterior and lateral radiographs of the elbow, after suture button fixation of the LUCL. The red arrows indicate the position of the suture button on the anterolateral aspect of the humerus. LUCL, lateral ulnar collateral ligament.



is first placed in a locking manner through the substance of the lateral collateral ligament. A 3.2-mm pin is then drilled from the posterior aspect of the lateral epicondyle anteriorly through the anterior cortex of the distal humerus (Fig 3). The two suture strands are passed through the cortical button in a standard fashion. The cortical button is then passed from the anatomic LUCL origin anteriorly through the drill hole. One should ensure that the suture button has flipped properly either under direct visualization or with the aid of fluoroscopy. Tension is placed on one end of the suture, locking the button into place. Then the ligament is tensioned under direct visualization by alternating tension on either end of the Fiberloop until appropriate stability of the elbow to varus and posterolateral rotatory stress has been restored (Fig 4). Finally, a free needle is used to pass one limb through the ligament to secure soft tissue tension, and both suture ends are used to tie the knot. The wound is then closed per the surgeon's preferences. Postoperative fluoroscopic images are taken in the operating room (Fig 5).

Postoperative Management

Postoperatively, the patient can be placed in a hinged elbow brace locked in 45-70° of extension or a long-arm splint. After 1 week, the patient can be transitioned to an unlocked hinged elbow brace. At 6-8 weeks postoperatively, the patient may bear weight, as tolerated, and can cease use of the hinged elbow brace. Elbow range of motion (ROM) was recorded at regular postoperative intervals.

Discussion

Injuries to the elbow, particularly those involving the lateral ulnar collateral ligament, can be difficult to

manage as recurrent instability is not uncommon. For terrible triad injuries, orthopedic surgeons must balance the restoration of ROM with a stable elbow joint. Reported complications following operative intervention of terrible triad injuries include instability, nonunion, malunion, stiffness, heterotopic ossification, infection, and neurovascular injury.² Patients who undergo delayed surgery or revision surgery experience ~20% loss of motion compared to those patients treated acutely,¹⁵ suggesting more acute intervention may help with final ROM. Up to 20% of patients require reoperation despite adequate restoration of elbow ROM and forearm rotation.¹⁵

The impetus for using this technique was recurrent instability after LUCL repair with suture anchor. Biomechanical studies have shown adequate repair of using transosseous sutures, suture anchors, and suture buttons in a variety of pathologies, including distal biceps and pectoralis major repair.^{9,14-18} The senior author began using the cortical button because of its improved control during the tensioning of the LUCL repair, aiming to provide anatomic fixation and prevent postoperative instability. The allowance for free sliding with the suture button permits minor adjustments in tension and, ultimately, a more anatomic repair.

Although the senior author primarily uses this technique for LUCL repair in trauma cases, the cortical button can also be used in primary LUCL reconstruction.

In the opinion of the senior author, there are few downsides to this technique. If the button is not securely fixed on the bone before final tensioning of the repair, the tension may be inadequate. Thus, it is important to ensure no soft tissue is entrapped between the button and the bone. Another technical pearl

Table 1. Suture Button Repair for Lateral Ulnar Collateral Ligament in Terrible Triad Injuries Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> • Ensure that there is no interposed soft tissue between the suture button and the bone. • Countersink the bony trough on the lateral aspect of the distal humerus to fully seat the suture button. Verify origin of LUCL complex before inserting guidewire. 	<ul style="list-style-type: none"> • Soft tissue interposition between the bone and suture button can lead to inadequate tensioning.

Table 2. Suture Button Repair for Lateral Ulnar Collateral Ligament in Terrible Triad Injuries Advantages and Disadvantages

Advantages	Disadvantages
<ul style="list-style-type: none"> • Improved dynamic tensioning of the LUCL repair • A more anatomic repair allows for free sliding and minor adjustments during tensioning of the LUCL. 	<ul style="list-style-type: none"> • Inadequate tension of the ligament could lead to posterolateral rotatory instability • Learning curve for appropriate button position and tension

Decreased postoperative immobilization and subsequent improved postoperative ROM

• Postoperative radiographic assessment of suture button position

includes countersinking the bony trough so that, when pulling the sutures through the drill hole, it seats fully with proper tensioning.

Conclusions

The use of suture button fixation for repair of lateral ulnar collateral ligament has not been previously described. The suture button has performed well biomechanically, clinically, and radiographically in other situations, and this report illustrates it as a technique worth considering for LUCL repair in terrible triad injuries. [Table 1](#) lists the pearls and pitfalls of suture button repair for lateral ulnar collateral ligament in terrible triad injuries. [Table 2](#) shows the advantages and disadvantages of suture button repair for lateral ulnar collateral ligament in terrible triad injuries.

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