



## Global elbow instability: a case report

Jacob Lytle, DO<sup>a,b</sup>, Amy Meyers, DO<sup>a,b,\*</sup>, Eric Ballard, DO<sup>a,b</sup>, Amir-Kianoosh Fallahi, MD<sup>c</sup>, Ryan Nelson, DO<sup>c</sup>

<sup>a</sup>Orthopedic Surgery Department, Ascension Genesys Hospital, Grand Blanc, MI, USA

<sup>b</sup>Michigan State University, Statewide Campus System, East Lansing, MI, USA

<sup>c</sup>Greater Michigan Orthopedics, Grand Blanc, MI, USA

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Elbow dislocations are a common orthopedic injury. It is the second most common dislocated joint in adults, the first being the shoulder. Dislocation represents ten to twenty-five percent of all elbow injuries.<sup>36</sup> These injuries commonly occur acutely after a fall on an outstretched hand with significant axial force, most commonly leading to posterolateral instability.<sup>35</sup> Dislocation at the elbow not only affects the bony articulations, but also causes significant soft tissue damage. The circle of Horii describes the acute mechanism of soft tissue failure during dislocation starting at the lateral collateral ligament (LCL) complex, leading to failure of the capsule, and finally failing at the medial collateral ligament (MCL).<sup>19</sup> One complication of these injuries is recurrent elbow instability.<sup>26–28</sup> This is a rare occurrence after a simple elbow dislocation.<sup>2,15</sup> Although rare, this is an important complication to be aware of after an acute simple elbow dislocation.

The elbow is a complex joint that is made up of a combination of a pivot and hinge joint from its articulation of the radiocapitellar and ulnohumeral joint, respectively. The elbow is stabilized through a conglomerate of its bony, ligamentous, and muscular attachments.<sup>18</sup> Stability at the elbow may be partitioned into static and dynamic stabilizers.<sup>38</sup> Primary static stabilizers consist of the LCL, the MCL, and the ulnohumeral articulation.<sup>8</sup> Secondary static stabilizers include the joint capsule, the radiocapitellar articulation, and the common flexor and extensor tendon<sup>7</sup> origins on the medial and lateral epicondyle of the humerus, respectively.<sup>38</sup> Dynamic stabilizers consist of the muscles that cross and compress the elbow. These include the anconeus, brachialis, biceps, and triceps muscles. Disruption to any of these stabilizers may lead to weakness, pain, and

recurrent instability. A significant amount of function is attributed to the stability at the elbow; loss of stability may affect the ipsilateral upper extremity with resultant functional deficits.<sup>26</sup> Early recognition of injury patterns that disrupt bony and soft tissue stabilization is vital to restoring elbow function, reducing the risk of chronic or recurrent instability, and decreasing chronic pain and weakness.<sup>35</sup>

Of the ligamentous primary static stabilizers, the LCL and MCL are composed of multiple bundles that contribute to various directions of stability. The LCL is composed of the lateral ulnar collateral ligament (LUCL), annular ligament, accessory lateral collateral ligament, and lateral radial collateral ligament (LRCL).<sup>12,29</sup> While the LCL complex is composed of multiple ligaments, the most important for stability during varus and posterolateral rotatory stresses is the LUCL.<sup>3,6</sup> Originating on the lateral epicondyle of the humerus, the LUCL inserts on the crista supinatoris or supinator crest.<sup>9,29</sup> Due to the origin and insertion of the LUCL, it is taut while the forearm is supinated. The MCL is composed of the anterior, posterior, transverse bundles.<sup>14,16</sup> These bundles resist valgus and distraction stresses and posteromedial rotatory stability.<sup>30</sup> Originating on the medial epicondyle of the humerus, the anterior bundle inserts on the sublime tubercle of the coronoid process,<sup>8</sup> while the posterior and transverse bundles insert on the sigmoid notch. Due to their origins and insertions, the MCL will be taut while the forearm is pronated. The anterior bundle is most important to restrain valgus stress and posteromedial rotatory instability.<sup>14,16,31</sup> The posterior bundle is the primary restraint during maximal flexion. The transverse bundle provides stability for the greater sigmoid notch without crossing the elbow joint.<sup>32</sup>

The triceps is a tri-pennate muscle with a long, lateral and medial head that originate on the infraglenoid tubercle of the scapula, posterior humerus superior to the radial groove, and the

\*Corresponding author: Amy Meyers, DO, One Genesys Parkway, ATTN: Medical Education, Grand Blanc, MI, 48439, USA.

E-mail address: [amy.meyers@ascension.org](mailto:amy.meyers@ascension.org) (A. Meyers).

**Table 1**  
Comparing the differences between posterolateral and posteromedial elbow instability.

Instability	Involved structures	Provocation physical exam
Posterolateral rotatory instability	<ul style="list-style-type: none"> <li>- LUCL</li> <li>- Tip of coronoid</li> <li>- Radial head fracture</li> <li>- Anterior band of MCL</li> </ul>	<ul style="list-style-type: none"> <li>- Lateral pivot shift</li> <li>- Posterior drawer</li> <li>- Chair rise</li> <li>- Floor pushup</li> <li>- Varus stress</li> <li>- Valgus stress</li> <li>- Milking maneuver</li> <li>- Moving milking maneuver</li> </ul>
Posteromedial rotatory instability	<ul style="list-style-type: none"> <li>- LUCL</li> <li>- Anteromedial portion of coronoid</li> <li>- No radial head fracture</li> <li>- Posterior band MCL</li> </ul>	

LUCL, lateral ulnar collateral ligament; MCL, medial collateral ligament.

posterior humerus inferior to the radial groove, respectively. The triceps inserts on the proximal end of the olecranon. Independent rupture of the distal triceps is a rare injury that commonly occurs from a forceful eccentric contraction or a fall on an outstretched hand.<sup>10,13,22</sup> The primary function of the triceps at the elbow is extension; however, it also contributes to valgus-varus stability at the elbow. Seiber et al demonstrated in an in-vitro study that release of the biceps, brachialis, and triceps caused an increase in varus-valgus laxity.<sup>33</sup> The dynamic stabilizing muscles at the elbow offload the ligamentous stabilizers by increasing bony stability through compressive forces across the joint.

Following closed reduction, the elbow should be critically assessed with a thorough physical exam to evaluate for any evidence of instability.<sup>21,25,37</sup> Range of motion (ROM) and varus and valgus stability are two important pieces of the physical exam. Normal ROM at the elbow is 0–140 degrees of flexion and extension, while the functional ROM is from 30–130 degrees. Normal pronation and supination ROM is 75 and 85 degrees, respectively, while functional pronosupination is 50 degrees. Provocative tests of the LCL are commonly tested by the lateral pivot shift, posterior drawer, apprehension, and chair rise tests.<sup>21,25</sup> The MCL is commonly tested by valgus stress, milking maneuver, and moving valgus stress test (Table 1). Advanced imaging may also be helpful to evaluate muscular and ligamentous structures.

Previous case studies have demonstrated the importance of the primary static stabilizers when treating an unstable elbow. Almalki et al contributed a case report of medial and lateral elbow instability after an acute atypical complex elbow dislocation.<sup>1</sup> They describe a case of a 38-year-old male with MCL and LCL disruption with a concomitant coronoid fracture. They go on to describe their technique for open reduction and internal fixation of the coronoid, repair of the LUCL, and reconstruction of the MCL.<sup>4,23</sup> They reported a successful outcome at 3 months by demonstrating a patient reported painless elbow and full ROM. Chen et al presented a case report of a 38-year-old male involved in a motor vehicle accident that presented with an acute posterior elbow dislocation with a radial head and olecranon fracture with concomitant MCL disruption.<sup>17</sup> They described performing radial head excision, open reduction and internal fixation of the olecranon, and MCL repair. At 6 months postoperative their patient demonstrated full ROM at the elbow and no signs of instability. Khalil et al contributed a case report of a pediatric patient that had a distal triceps rupture with MCL rupture after a football injury.<sup>20</sup> They described their approach to repair of the distal triceps and conservative treatment of the MCL. They reported a successful return to a preinjury level to sport. These case studies provide insight into the complexity of treating elbow injuries that cause instability. They also demonstrate the importance of restoring the anatomic attachments and articulations at the elbow for stability, ROM, pain, and function.<sup>1</sup>

In this report, we present a rare case in a 66-year-old male with a simple elbow dislocation with concurrent LRCL, MCL, common extensor rupture, and distal triceps rupture following an acute fall

from a height, leading to subsequent recurrent global instability. To our knowledge there have been no reported cases of recurrent global instability from concurrent LRCL, MCL, common extensor rupture, and distal triceps rupture following a simple elbow dislocation. This report reviews the initial presentation, diagnosis, initial management, and operative summary.

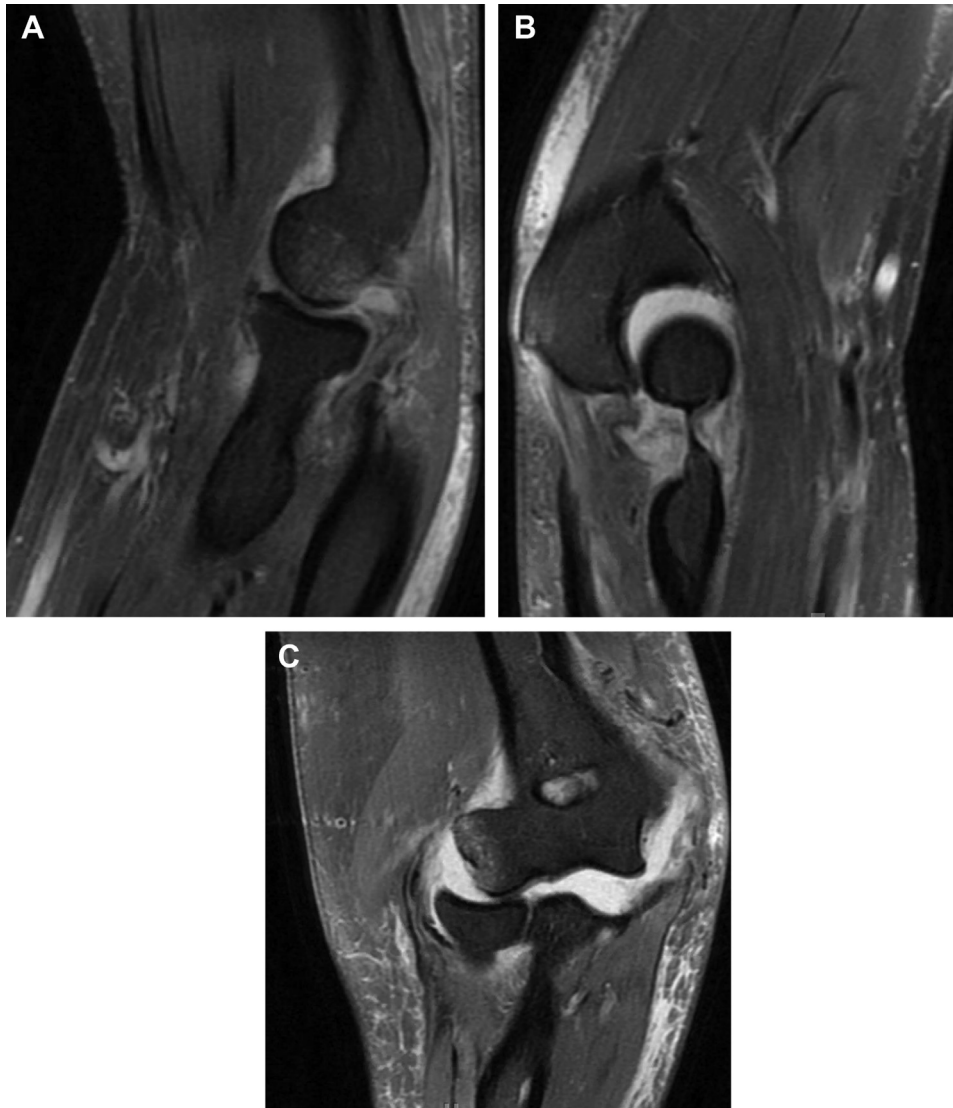
### Case presentation

Patient is a 66-year-old male who sustained an initial left elbow dislocation after falling out of a tree stand. He was able to self-reduce the dislocation and then experienced multiple instability events over the next 2 weeks prior to presentation. He had no previous injuries to this elbow and had no other injuries. Physical examination of the injured extremity revealed intact skin with diffuse edema and medial and lateral ecchymosis as well as posterior ecchymosis over the arm. There was tenderness globally with palpable effusion and a palpable defect in the triceps tendon. His elbow ROM was from 20 to 130 degrees with 60 degrees of both supination and pronation. There was significant laxity with both varus and valgus stress. His triceps strength was decreased at 4/5. Plain film examination revealed gapping of the medial joint line with subluxation of the ulnohumeral joint. There were no associated fractures or radiopaque foreign bodies or intra-articular loose bodies identified. Magnetic resonance imaging (MRI) of the elbow demonstrated triceps avulsion with MCL rupture, common extensor rupture, and radial collateral ligament rupture (Fig. 1, A–C).

### Operative technique

The patient was placed supine on the exam table, prepped, and draped. An exam under anesthesia demonstrated valgus and posterolateral rotatory laxity, representing global instability of the elbow. A posterior incision starting from the distal one-third humerus to the proximal one-third ulna was made. Full thickness medial and lateral flaps were created and the ulnar nerve was decompressed. The humeral head of the flexor carpi ulnaris was elevated off the humerus. The remnants of the medial ulnar collateral ligament were identified and noted to be irreparable. The interval between the anconeus and extensor carpi ulnaris was used to expose the LCL complex. The LCL complex was identified and noted to have avulsed from the origin on the lateral humeral epicondyle. The avulsed ligament was deemed satisfactory for repair and a whipstitch was placed proximally and distally with four strands. Our isometric point was then determined by approximating tension with a provisional reduction and moving the elbow through a ROM as described by O’Driscoll et al.<sup>29</sup> A 3.5 mm swivel lock was then placed into the origin of the LCL complex (Fig. 2, A and B). Testing of the repair demonstrated resolution of posterolateral rotatory instability with residual valgus instability.

A palmaris longus autograft was harvested by making three transverse incisions at the wrist, mid-forearm, and proximally,



**Figure 1** MRI images demonstrating triceps avulsion with MCL rupture (A), common extensor rupture (B), and radial collateral ligament rupture (C). MCL, medial collateral ligament.

taking the longest graft possible. The palmaris longus was then whipstitched and sized to a 3.5 mm graft. Once sized and prepared, the humeral origin of the MCL was identified. A bone tunnel was then drilled anterior to posterior with a 4mm drill bit. A suture button was then passed through our bone tunnel and flipped on the posterior cortex under direct visualization. Next, the anterior limb of the autograft was anchored at the sublime tubercle using a swivel lock. The posterior limb was then anchored just posterior to the anterior limb with a second swivel lock. The graft was then tensioned into the humeral tunnel using the sliding suture button (Fig. 2, A and B). The elbow was then stressed under fluoroscopy and demonstrated stability to valgus stress and maintained posterolateral stability. Pronation and supination demonstrated no lift off/gapping of the joint. The triceps avulsion was then repaired with Krakow stitches in the proximal musculotendinous junction. Next, we drilled oblique tunnels in the posterior aspect of the ulna. We then placed an Arthrex fiber link suture tape through the medial and lateral side of the triceps. The Krakow suture ends were passed successively through the bone tunnels in the ulna. We then crossed our stitches with a fiber link and these were repassed through the bone tunnels again for tensioning. The suture limbs were then anchored with a 4.5mm swivel lock placed distal to the bone tunnels

(Fig. 2, A and B). The arm was ranged and no lift off or gapping was appreciated. Final fluoroscopy films (Fig. 3, A–C) were taken demonstrating normal joint congruity. After closure, the elbow was placed in a posterior long arm splint with 60 degrees of flexion.

#### Postoperative course

Postoperatively he was immobilized in a posterior splint with medial and lateral struts in slight 45 degrees of flexion to facilitate triceps repair for 2 weeks. At the first postoperative visit he was transitioned to a hinged elbow brace with active and passive ROM allowed from 0-90 degrees. Weight lifting restrictions were limited to the weight of a coffee cup. Initial x-rays demonstrated satisfactory alignment and position without evidence of joint space widening or instability. At 6 weeks, the patient reports he is doing better with significant pain relief, but reports difficulty with his ROM and weakness. Upon physical exam, full pronosupination and ranges from 5-110 degrees in flexion and extension. The brace was discontinued and the patient was started on full ROM and strengthening physical therapy protocols. At 3 months, the patient continued to be doing better and had no further improvement of ROM from his exam at 6 weeks postoperative.

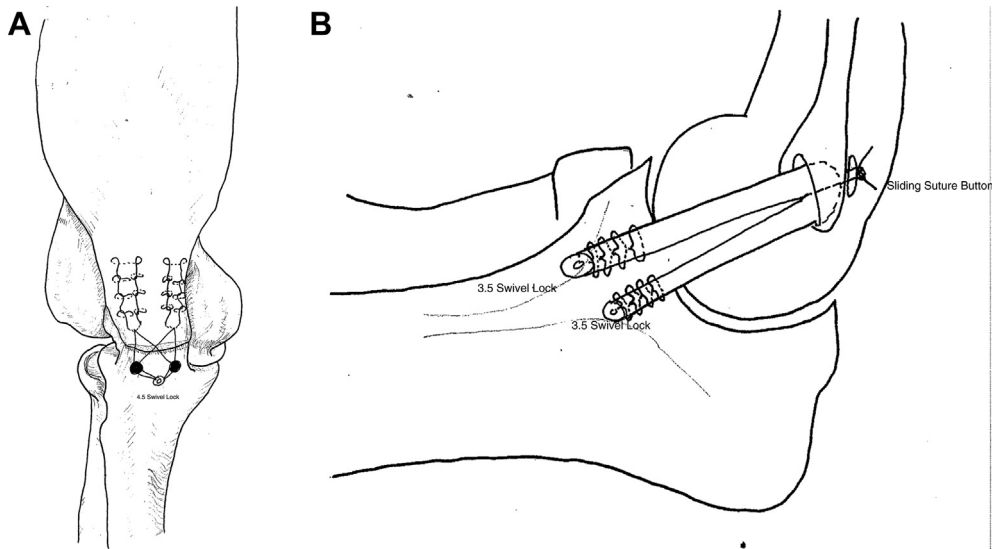


Figure 2 Diagram of intraoperative anchor (A) and suture button placement (B).

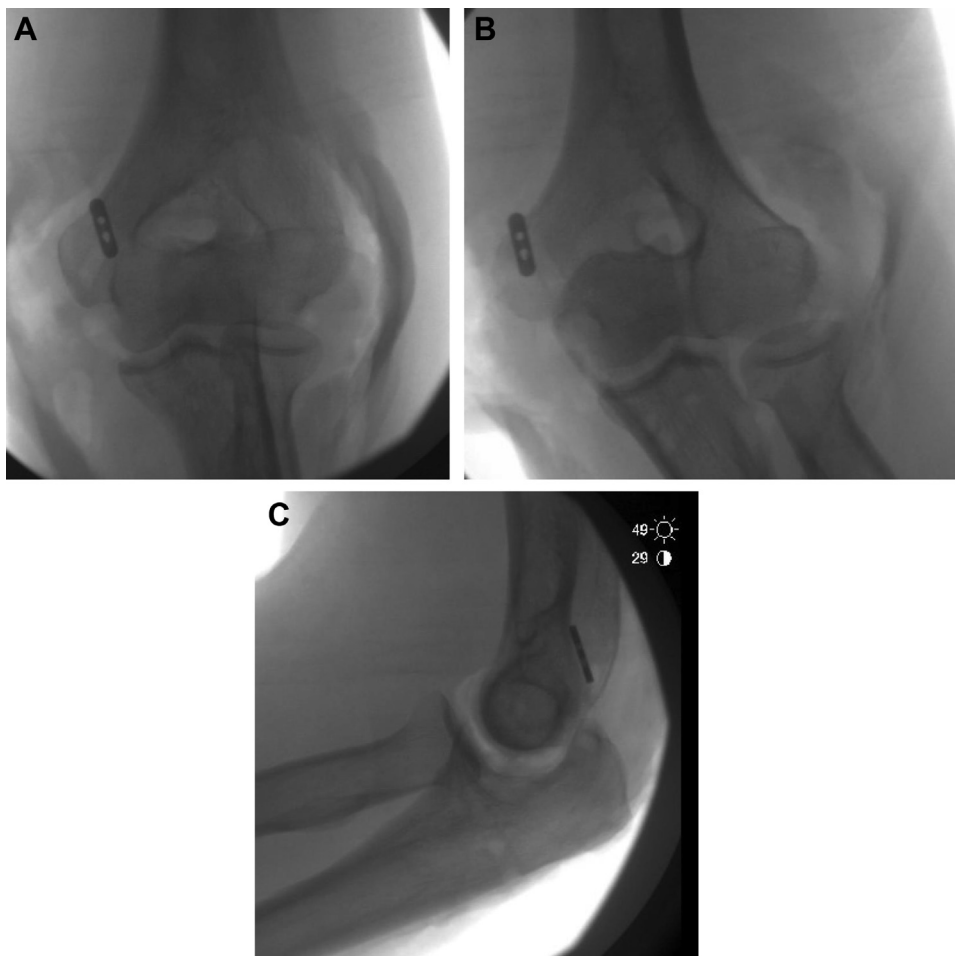


Figure 3 Final intraoperative imaging, AP (A), oblique (B), and lateral (C), demonstrating normal joint congruity.

## Discussion

The elbow is a complex joint that requires a wide understanding of its bony articulations, ligamentous and muscular attachments, and nearby neurovascular structures. Although rare, recurrent instability is an important complication that must be assessed after an acute

elbow dislocation.<sup>17,18</sup> Our case report presents on an extraordinarily rare injury. Canbora et al and Karuppiah et al describe case reports of triceps avulsion with terrible triad injuries involving MUCL ligament injury with radial head fracture. Our case report is unique as the injury pattern involves rupture of the triceps with purely ligamentous injury without bony injury. This is different from these case

reports.<sup>5,19</sup> The diagnosis should be made through a thorough history and physical exam.<sup>35</sup> Key characteristics that should alert you are history of multiple dislocations that are easily reduced or subjective apprehension with certain positions of the upper extremity.<sup>11,24,36</sup> These events may impair ROM, strength, and cause chronic pain that further decreases functional ability at the elbow. The physical exam should assess these deficits such as, neurovascular status, ROM at the elbow, valgus and varus stress, and strength. Radiographs should be utilized to evaluate for any obvious or occult fractures. Advanced imaging, such as MRI, assists with evaluating ligamentous and muscular structures and may also help with surgical planning.<sup>25</sup> Tarallo et al demonstrated that preoperative MRI scans had high interobserver agreements in intraoperative findings of LCL tears.<sup>15</sup> However, their results were poor for intraoperative MCL tears. Advanced imaging is an extremely helpful tool for orthopedic surgeons; however, they are an expensive modality and may also prove to be less helpful than previously thought.<sup>32,34</sup>

In our review of the current literature we were unable to find any case reports of recurrent instability at the elbow due to a concurrent LCL, MCL, and triceps insufficiency. In our case report, we were unable to assess the patient at his initial elbow dislocation event due to his late presentation to the office. The patient was able to reduce his elbow by himself and did not come for evaluation until 2 weeks after his initial injury. We described successful treatment of global elbow instability with surgical management.

## Conclusion

Simple elbow dislocations are a common orthopedic injury and can most often be treated conservatively.<sup>15</sup> However, a rare complication of acute elbow dislocations is recurrent instability. This must be assessed for throughout management of simple elbow dislocations. Recurrent instability is a complex injury that requires surgical intervention.

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