Technical Note

Posterolateral Elbow Dislocation: An All-Arthroscopic Reconstruction of the Lateral Ulnar Collateral Ligament

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Abstract: The elbow is one of the most commonly dislocated joints. Although simple dislocations of the elbow usually resolve with conservative management, certain patients can experience residual chronic instability. Posterolateral rotational instability accounts for approximately 80% of elbow chronic instability cases. We propose an all-arthroscopic reconstruction of the posterior, or ulnar, fascicle of the lateral ligament complex using an autograft or allograft, performed with a 5-mm-thick and 8-cm-long graft. The graft is first inserted distally into the supinator crest with an Arthrex 4.75-mm SwiveLock implant and, finally, at its origin in the epicondyle, also with a screw of the same characteristics. Arthroscopic techniques create fewer complications. This procedure allows the surgeon to address intra-articular elbow joint pathology with less chance of wound complications and the ability to use bone anchors if desired.

The elbow is one of the most dislocated joints. Acute dislocations resulting in chronic elbow instability are disabling complications.[1-3] Posterolateral rotational instability (PLRI) accounts for approximately 80% of elbow chronic instability cases.[1,2] Generally, it occurs after elbow trauma. It presents as posterolateral rotatory subluxation of the radial head and ulna from the humerus when axial load is applied in supination. It is caused by ligamentous insufficiency of the lateral collateral ligament complex, more specifically of the lateral ulnar collateral ligament (LUCL).[1,3]

The lateral ligament complex (Fig 1) comprises a triangular structure with a common origin in the epicondyle from which an anterior fascicle (radial collateral ligament) and a posterior fascicle (LUCL) emerge, and a communication between them forms the annular ligament. The posterior fascicle is inserted into the supinator crest, which is located 4 to 5 mm from the lower edge of the lesser sigmoid fossa.[3] Posterolateral rotational instability encompasses a whole spectrum of symptoms, some of which can be subtle; however, operative treatment should be performed. Surgical treatment is generally associated with a high rate of satisfactory outcomes.[3,4]

Surgical Technique

We propose an all-arthroscopic reconstruction of the ulnar fascicle of the lateral ligament complex using an autograft or allograft (Fig 2, Video 1). A 5-mm-thick and 8-cm-long graft is used. It is usually an internal rectus autograft, although it can also be a cadaveric allograft (Fig 3). To calculate the length of the graft, the distance between the epicondyle and the ulnar insertion point in the supinator crest is measured with a ruler. It is usually 4 or 5 cm long. To that distance, we add 2 cm that is introduced in the ulnar tunnel, and another 2 cm that is introduced in the humeral tunnel, resulting in a graft that is 8 or 9 cm in length. Two Krakow-type sutures are made at both ends. The graft is

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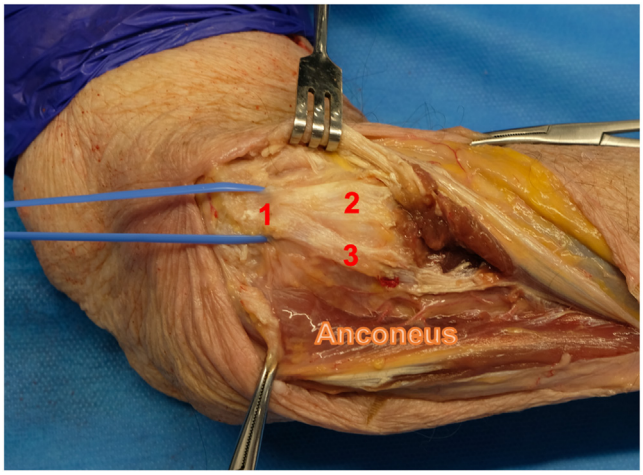

Fig 1. Anatomical dissection of the LLE of a right elbow. 1: Epicondyle origin. 2. Radial fascicle of the lateral ligament. 3. Ulnar fascicle of the lateral ligament.

first inserted distally into the supinator crest with a 4.75-mm SwiveLock implant (Arthrex, Naples, FL) and, finally, at its origin in the epicondyle, also with a screw of the same characteristics (Video 1).

The operation is performed with the patient in lateral decubitus position. The arm is laid on the arm rest device with the elbow placed in 90° of flexion. A pneumatic tourniquet is applied on the arm proximally.

The procedure begins with the establishment of a soft-spot portal to perform a diagnostic arthroscopy (Fig 4). The disinsertion of the lateral ligament complex origin on the lateral epicondyle, the annular ligament, the proximal radioulnar joint, and possible fractures or chondral injuries can be identified (Fig 5). We can also check elbow instability, appreciating the ulnohumeral gap greater than 2 mm when valgus load and forearm supination is applied.

Then, the medium anterolateral portal, at the joint line level, and an accessory soft-spot portal, 2 or 3 cm proximal to soft spot, are positioned under direct vision. Synovectomy is performed, and the point of origin of the lateral ligament complex in the epicondyle is identified.

First, the distal insertion is performed in the supinator crest, identifying with an image intensifier the point lying 4 or 5 mm from the lower margin of the lesser sigmoid fossa and, in the center between the anterior and posterior cortical of the ulna (Fig 6). Through a mini-open, we introduce first the guidewire at that point, followed by the drill bit with which we are going to brocade a 4.5-mm diameter and 20-mm length tunnel. Finally, the 4.75-mm SwiveLock anchor graft is inserted.

Then, we drill the humeral tunnel (Fig 7). Initially, a mini-open is performed on the medial epicondyle to support the "C" guide of the anterior cruciate ligament through which the guidewire will enter (identifying and ensuring that we do not injure the ulnar nerve). The opposite area of the guide is introduced through the anteromedial portal (Fig 8), supporting the guide on the origin of the ligament in the lateral epicondyle (Table 1). The guidewire is introduced from the medial side to the lateral side (it also can be done the other way around, but this way we can control the medial epicondyle and avoid injuring the ulnar nerve). Once the guide needle comes out, we change the vision to the soft point portal and take the needle out through the medial anterolateral portal (Fig 9). A brocade 30 mm in length and 4.5 mm in diameter is introduced from the lateral side to the medial side (a soft-tissue protector can be used). A looped suture is placed in the eyelet of the guide needle (Figs 10 and 11), and we obtain the loop through the medial anterolateral portal pulling the needle from the lateral side (the other end is in the medial epicondyle to be pulled later).

A grasper is passed under the anconeus muscle from the origin of the graft in the ulna and exits through the

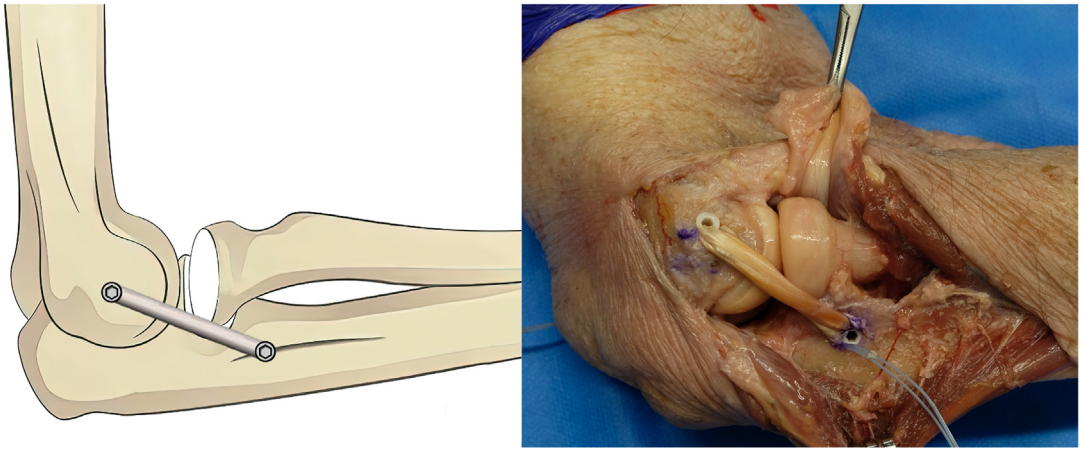

Fig 2. Design of the graft with an epicondyle origin and the insertion in the supinator crest of the ulna of a right elbow. A 5-mm thick graft is shown.

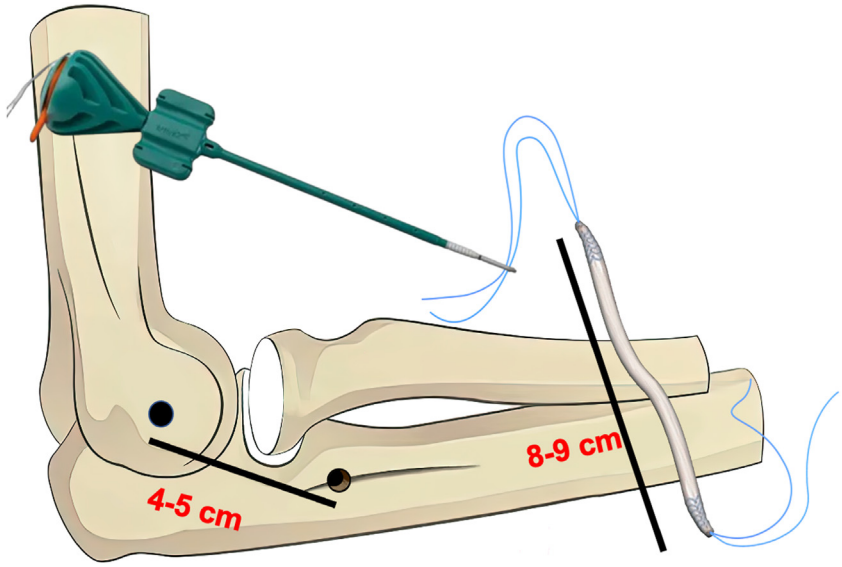

Fig 3. An 8-cm long graft of a right elbow with a Krackow suture at both ends and a diameter of 5 mm is shown. We can appreciate bone tunnels in the humerus and in the ulna with a brocade of 4.5 mm diameter and 20 mm length in ulna or 30 mm length in the humerus.

medial anterolateral portal. We take the loop and take it out in the ulnar insertion of the graft. Afterwards, the Krakow suture of the free end of the graft is threaded.

Finally, the suture is pulled with a loop from the medial side (Figs 12 and 13), and the graft is passed below the anconeus muscle, entering the humeral tunnel (all under the control of scope with the arthroscopy camera on the soft point). The graft is tightened at 60° of flexion and medium pronosupination (Table 1) and stabilized in the humeral tunnel with a 4.75-mm SwiveLock screw (or a 4.75-mm biotenodesis screw). The blind tunnel is longer than the

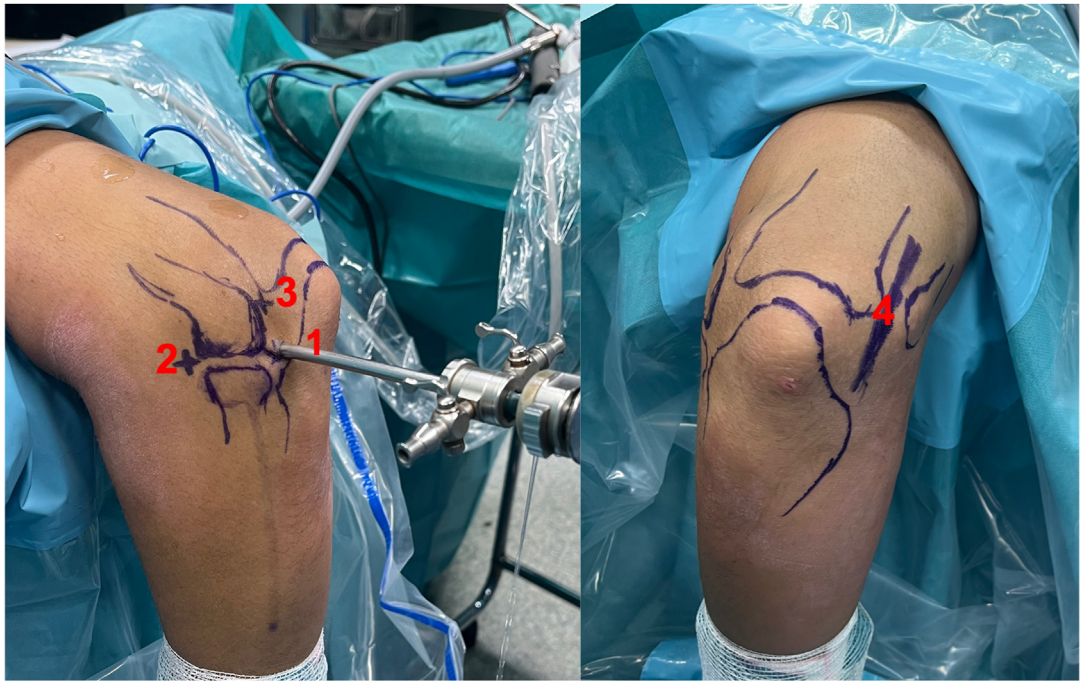

Fig 4. The operation of the left elbow is performed with the patient in a lateral decubitus position. The arm is laid on the arm rest device with the elbow placed in 90° of flexion. 1: Soft-point portal. 2: Portal anterolateral medium. 3: Accessory soft-point portal. The procedure begins with the establishment of a soft-point portal. Then, the medium anterolateral portal, at the joint line level, and an accessory soft-spot portal, 2 to 3 cm proximal to soft-spot, are positioned under direct vision. 4: Ulnar nerve.

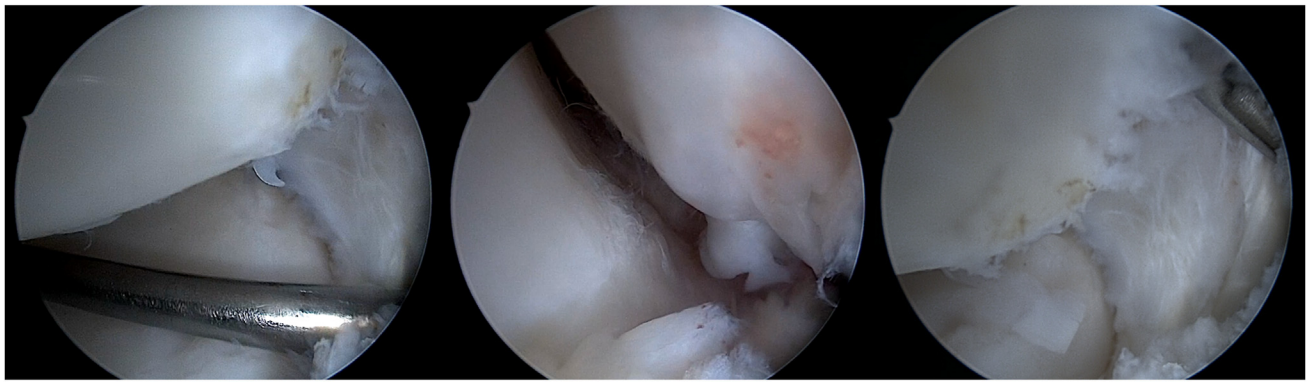

Fig 5. Exploration of the joint and of the disinsertion of the lateral collateral ligament viewed from the accessory soft-spot portal in lateral decubitus of the left elbow.

graft to be able to provide the required tension without a bone stop (Fig 14), as only 2 cm of graft is inserted into a 3- to 3.5-cm tunnel.

Rehabilitation

Immediately after surgery, the elbow is immobilized using a splint in 90° of flexion and neutral forearm rotation for the first 2 weeks. Afterwards, we switch it for a hinge elbow brace for 4 weeks. We allow the patient to reach full flexion since the beginning, but only carry up to 30, 15 and full degrees of extension at 2, 4, and 6 weeks postoperatively. Isometric arm muscle strengthening is allowed immediately after removing the splint. At 6 weeks postoperatively, active and active-assisted exercises are allowed. Pronation and supination are practiced with the elbow in 90° of flexion, keeping the arm by the side of the trunk. At 12 weeks postoperatively, activities that require pivoting are allowed.

Discussion

Posterolateral rotatory instability is a disabling complication, and most authors consider surgical management of posterolateral rotatory instability of the elbow the standard treatment because surgical treatment results in good functional outcomes and patient satisfaction. Surgical treatment aims to restore the stability of the ulnohumeral joint by restoring the LUCL.[3,4] PLRI generally requires LUCL reconstruction. Currently, there is no clinical evidence demonstrating the superiority of autografts or allografts.[5]

Several surgical reconstruction techniques and graft configurations have been described for the treatment of PLRI, including the Jobe technique, the Docking technique, and the single-strand technique. All these techniques have good and reliable results.[4]

The results of previous studies suggest that the location of the ulnar tunnel may not be as critical as the one of the humeral tunnel for LUCL reconstruction.[6]

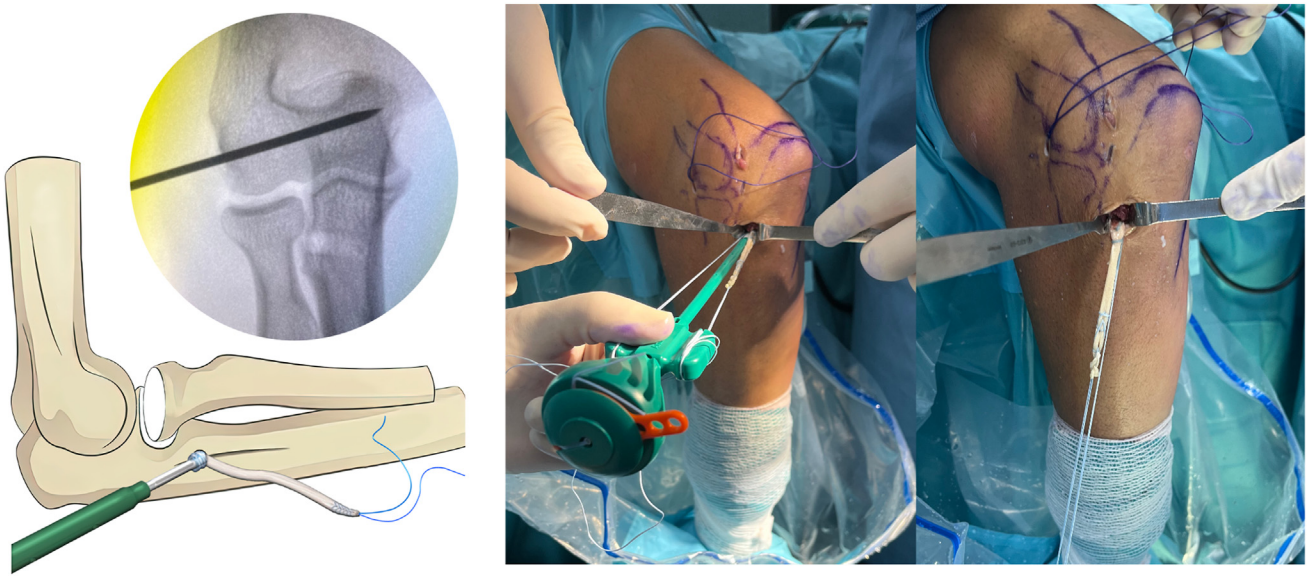

Fig 6. On the left, the insertion of the graft in the supinator crest and the tunnel vision of 4.5 mm diameter and 20 mm length in the scope. On the right, the graft is stabilized with a 4.75-mm SwiveLock.

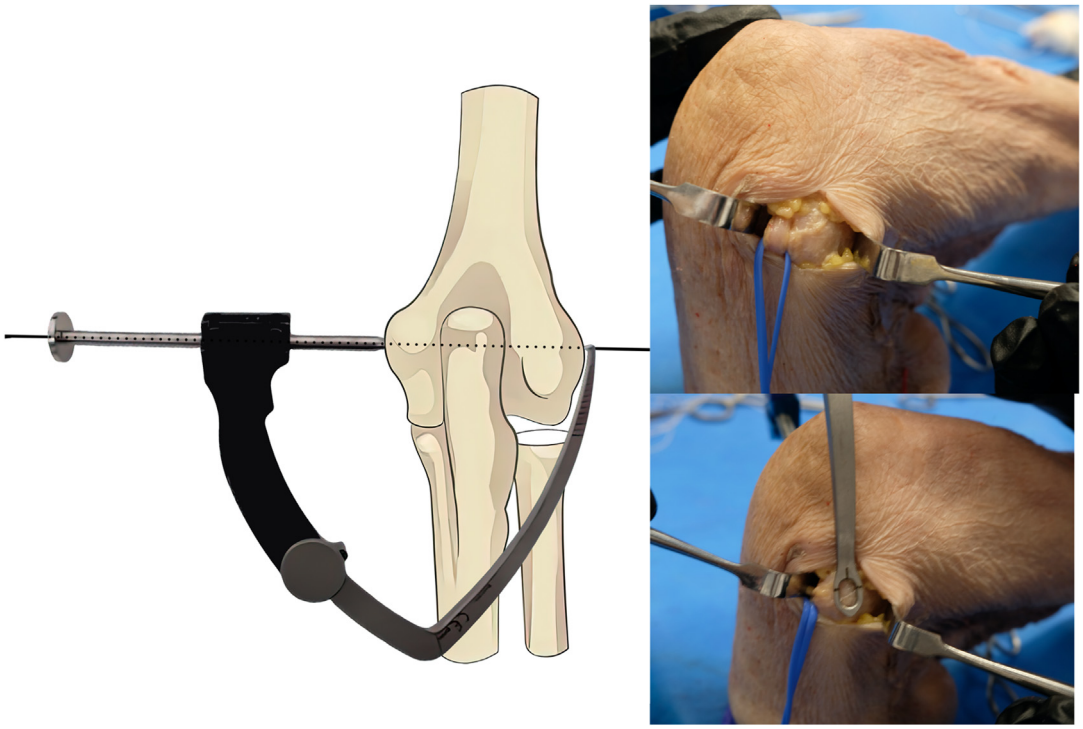

Fig 7. With the patient in a lateral decubitus position a miniopen is performed in the medial epicondyle of the left elbow to support the guidewire and avoid ulnar nerve injury (referenced with blue vessel loop).

Fig 8. Steps for the making the humeral tunnel in lateral decubitus of the left elbow. In the left image, the lateral anteromedial portal camera is shown. The guidewire is supported by the medial epicondyle with a mini-open and the lateral epicondyle through the soft point with arthroscopic vision. The needle runs from medial to lateral. In the upper left image, you can see the guidewire resting on the lateral epicondyle and, in the lower image, how the needle comes out.

Table 1. Pearls and Pitfalls

- Reproducible and safe technique to address residual instabilities that can occur with conservative treatment of acute elbow instability.
- Obtain adequate visualization of the joint to confirm instability and to diagnose and treat concurrent intra-articular pathology.
- The point of origin of the lateral ligament complex in the epicondyle is identified and should be adequately debrided.
- The location of the ulnar tunnel may not be as critical as that of the humeral tunnel. The ulnar tunnel should be located at the radial head-neck junction or distal to it. An appropriately positioned humeral attachment site is typically at the geometric center of a circle superimposed on the capitellar articular margin.
- When the graft is tightened at 60° of flexion and medium pronosupination, the elbow is in a reduced position, which can be visualized by arthroscopy.

Posterolateral rotatory elbow stability can be achieved reasonably well as long as the ulnar tunnel is located at the radial head-neck junction or distal to it.[6] The humeral tunnel is typically at the geometric center of a circle superimposed on the capitellar articular margin.[3]

Once surgery is necessary, both open and arthroscopic acute repair can be performed, with excellent patient outcomes.[7] Surgeons should perform an arthroscopic elbow joint examination before the procedure to confirm instability and to diagnose and treat concurrent intra-articular pathology. Arthroscopy allows a direct and dynamic approach to the ulnohumeral joint so that the degree and the pattern of instability can be quantified by several arthroscopic tests, which have been described.[8] The definitive treatment can be performed arthroscopically at the same time, providing a direct evaluation of ligament tensioning[8] (Table 2).

Arthroscopic procedures are associated with fewer complications and with smaller incisions that result in less soft-tissue dissection and donor-site morbidity. This procedure allows the surgeon to address intra-articular elbow joint pathology but also allows earlier weightbearing, less chance of wound complications, and the ability to use bone anchors if desired (Table 2). However, these techniques require an experienced surgeon, are technically demanding and require precision, and there has been no comparative study of biomechanics or clinical results with the previous techniques (Table 2).

There are different treatment options in chronic instability, from osteophyte resection, bone block

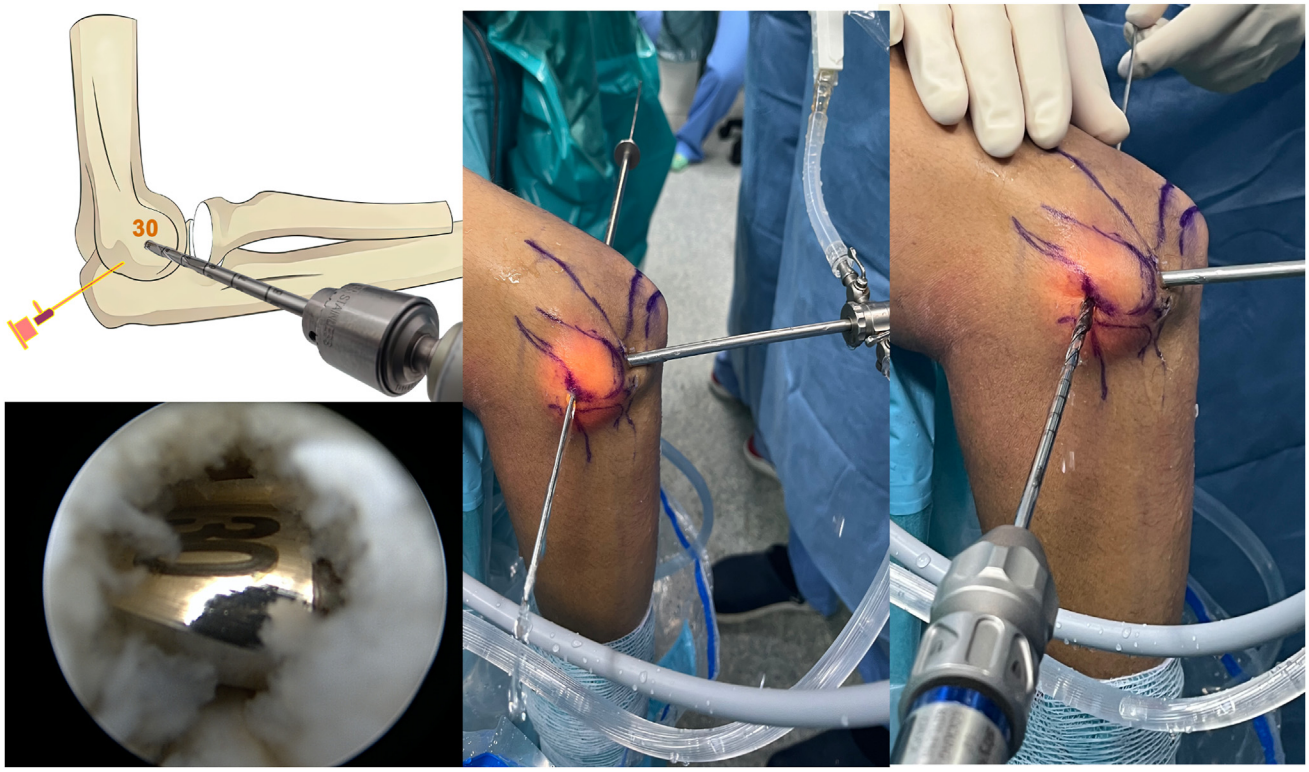

Fig 9. When the needle comes out through the lateral epicondyle of the left elbow in lateral decubitus (lateral anteromedial portal view), the vision is changed to the soft point and the needle is taken out through the lateral anteromedial portal. Afterwards, a 4.5-mm diameter and 30-mm length brocade is made under arthroscopic control.

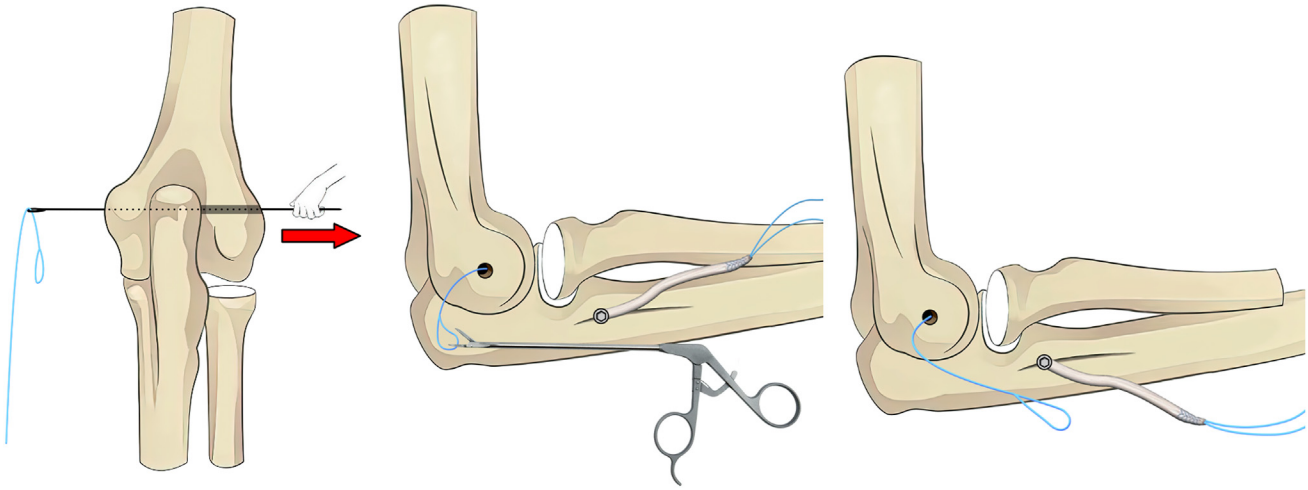

Fig 10. Diagrams of the left elbow in lateral decubitus. A looped suture is placed on the guide needle. We pull the guidewire from the lateral side and take it out through the lateral anteromedial portal. Then, we insert a grasper from the mini-open initially made on the supinator crest (below the anconeus muscle) to bring the loop to the ulna insertion of the graft.

methods, and tendon transfer to arthroscopic reconstruction of the lateral collateral ligament complex.[9,10] Studies have reported similar and good functional outcomes in the short term. Nonetheless, reconstruction of the lateral collateral ligament often is performed in young patients, who generally have a long life expectancy.[4] These patients have high demands regarding the functional outcome of the surgical procedure to maintain jobs and physical activities.

We can conclude that arthroscopic isolated reconstruction of the LUCL with allograft is safe, allowing restoration of joint stability and presenting low surgical morbidity. However, there are no large published series on the outcomes of arthroscopic surgical treatment of rotational posterolateral instability, and few studies

Fig 11. Operative images of the left elbow in lateral decubitus. A looped suture is placed on the guide needle and, pulling the guide needle from the side, it is taken out through the lateral anteromedial portal. Then, we insert a grasper clamp from the mini-open initially made on the supping ridge (below the anchor) to bring the loop to that point.

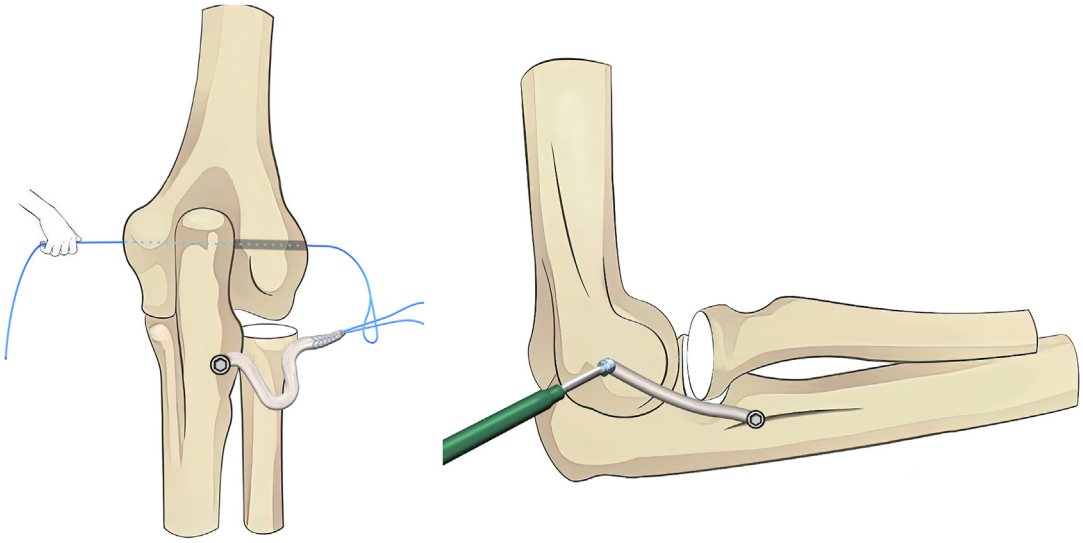

Fig 12. The Krackow suture of the free end of the graft is threaded into the loop and is pulled from medial side to the lateral side. Also shown is introducing the graft into the humeral tunnel of the left elbow in lateral decubitus, where the graft is stabilized with a 4.75-mm SwiveLock screw (or 4.75-mm biotenodesis screw).

have been published on the results after arthroscopic reconstruction. However, studies report promising results after surgical repair. We believe that the presented arthroscopic technique is reproducible and achieves the reconstruction of the LUCL of the elbow as well as avoids residual instability.

Disclosures

All authors (F.M.M., C.M.G., A.G.L., M.V.A., J.L.C-G., C.S.P.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

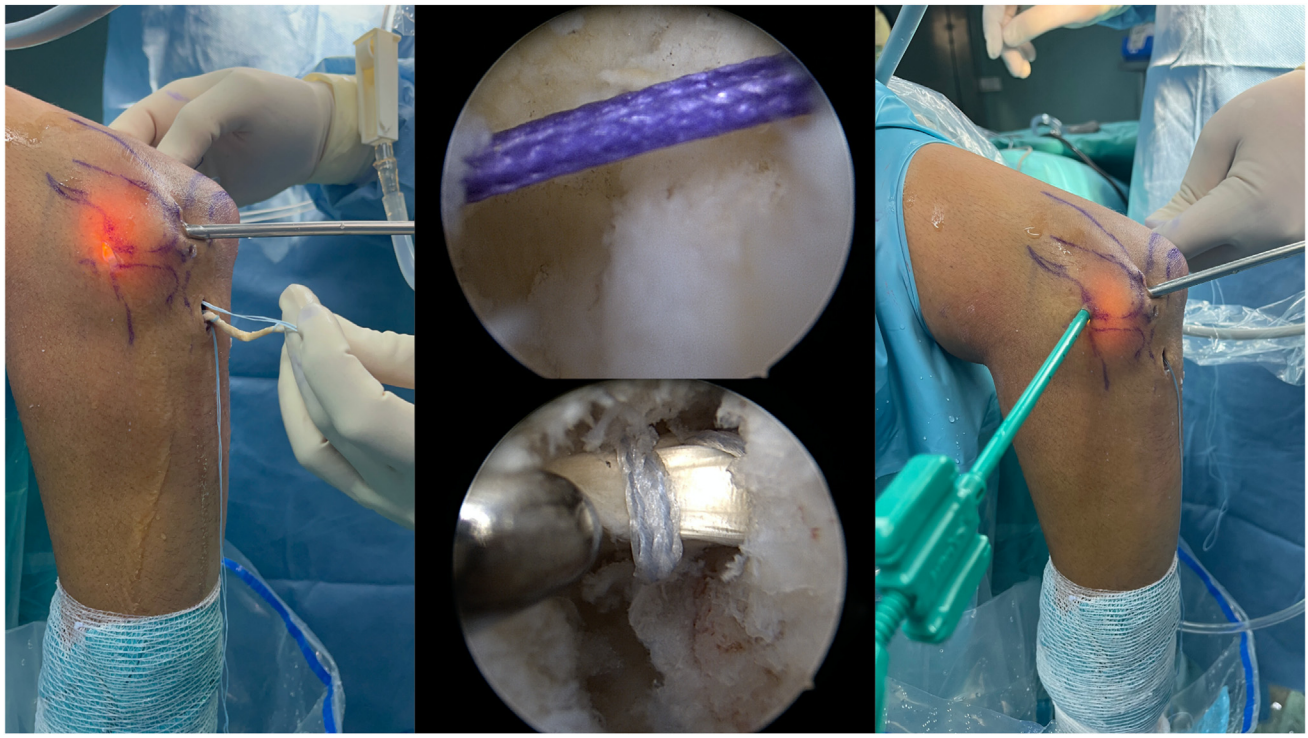

Fig 13. On the left, we pull from the medial side to pass the graft under the anconeus muscle, and in the middle arthroscopic image we introduce it into the humeral tunnel. It is finally stabilized in the humeral tunnel with a 4.75-mm SwiveLock screw (or a 4.75-mm biotenodesis screw) in the right image.

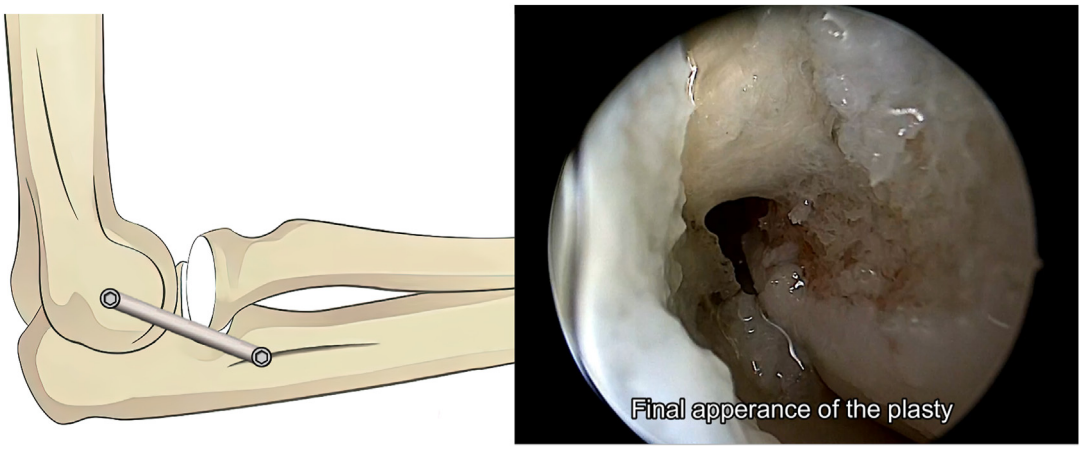

Fig 14. Diagram and arthroscopic image of the final appearance of the graft after its anchoring of the left elbow in lateral decubitus.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Less donor-site morbidity	Requires an experienced surgeon
Less soft-tissue dissection	Technically demanding and requires precision
Surgeons frequently should perform an arthroscopic elbow joint examination before the procedure to confirm instability and to diagnose and treat concurrent intra-articular pathology. Therefore, it allows the treatment of intra-articular elbow joint pathology.	Too much tension during soft-tissue tightening leads to difficult range of motion exercise during the early postoperative period
Earlier weight-bearing	There has been no comparative study of biomechanics or clinical results with the previous techniques
Less chance of wound complications	
The possibility of using bone anchors if desired	
Avoidance of the graft donor-site morbidities compared with tendon graft construction techniques	
Avoidance of violation at the osteoligamentous junction, which contains proprioceptive nerve endings	

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