Technical Note

Arthroscopic Techniques to Recognize and Quantify Subtle Medial and Lateral Elbow Instability

Aaron M. Mullane, M.D., and Larry D. Field, M.D.

Abstract: The diagnosis and treatment of elbow instability can be challenging for surgeons. Although history, physical examination, radiographs, and advanced imaging such as stress ultrasound scanning and magnetic resonance imaging are helpful, diagnostic arthroscopy is a valuable tool in the armamentarium of an elbow surgeon. Elbow arthroscopy is not only a diagnostic tool but also has the added therapeutic benefits that are not available with other diagnostic modalities. The purpose of this article and associated video is to present 3 arthroscopic techniques to help elbow surgeons arthroscopically recognize and quantify medial and lateral elbow instability.

Even for the most experienced surgeons, it is difficult to accurately recognize and treat elbow instability. The clinical presentation can be acute or chronic and with or without a history of recurrences. In addition, presentations can range from subtle instability to obvious deformity as seen with an elbow dislocation. Subtle instability can be particularly challenging to identify and quantify. Current options available to assist elbow surgeons in recognizing instability patterns include the history and physical examination, static and dynamic radiographs, ultrasound evaluation, magnetic resonance imaging, and diagnostic arthroscopy.

The purpose of this article, and the associated technique video (Video 1), is to present three arthroscopic techniques (arthroscopic evaluation for valgus instability, arthroscopic anterior elbow compartment evaluation for varus instability, and arthroscopic posterior compartment evaluation for posterolateral rotatory instability) to assist surgeons in recognizing and quantifying medial and lateral elbow instability. Although more invasive than stress ultrasonography and stress radiography, elbow arthroscopy, when indicated, allows for the direct assessment of ligamentous stability and tissue quality and has the added advantage of providing therapeutic benefits such as arthroscopic debridement, loose body removal, spur excision and can facilitate arthroscopically assisted lateral ulnar collateral ligament plication or reconstruction (Table 1).[1,2]

Surgical Technique

After induction of general anesthesia and after comparing stability of both elbows with the patient under anesthesia, the patient is positioned prone or laterally with the operative extremity in an arm holder. The arm is then prepared and draped in standard, sterile fashion. Diagnostic elbow arthroscopy of the anterior compartment using a 30° arthroscope (Smith & Nephew, Memphis, TN) is then performed using proximal anterolateral and proximal anteromedial portals.

After anteromedial and anterolateral portals are established, the "arthroscopic valgus instability test" can then be performed to evaluate for competency of the medial ulnar collateral ligament. This test is accomplished while visualizing the medial ulnohumeral joint from the anterolateral portal with the elbow in approximately 70° of flexion. A valgus stress is then placed on the elbow to a firm endpoint. If valgus instability is present, pathologic opening of the medial ulnohumeral joint will be visualized. Medial ulnohumeral joint opening of 2 mm or greater confirms insufficiency of the medial ulnar collateral ligament (Figs 1, 2).

From the Mississippi Sports Medicine and Orthopaedic Center, Jackson, Mississippi, U.S.A.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received February 27, 2023; accepted April 22, 2023.

Address correspondence to Larry D. Field, M.D., Mississippi Sports Medicine and Orthopaedic Center, 1325 E Fortification St., Jackson, MS 39202, U.S.A. E-mail: Larry.Field@msmoc.com

2212-6287/23298

https://doi.org/10.1016/j.eats.2023.04.029

Table 1. Advantages/Disadvantages of Arthroscopic Evaluation of Medial and Lateral Elbow Instability

Advantages
Direct assessment of joint laxity presence and degree is provided under mechanical loaded conditions.
Elbow arthroscopy also provides the opportunity for concurrent therapeutic interventions.
After completion of arthroscopic or open instability repair or reconstruction, elbow stability can be arthroscopically reassessed.
Disadvantages
Arthroscopic evaluation for elbow instability is more invasive than other modalities such as magnetic resonance imaging, stress radiographs, or ultrasound scanning.

The presence and degree of lateral ulnar collateral complex instability can be evaluated using the arthroscope in the anterior compartment. While visualizing the radiocapitellar joint from the proximal anteromedial portal and the elbow in approximately 90° of flexion, a varus stress is then placed on the elbow to a firm endpoint (Figs 3, 4). In cases of lateral ulnar collateral ligament incompetency, pathologic radiocapitellar joint opening is seen. If enough varus opening is present arthroscopically, then it is sometimes even possible to advance the arthroscope directly into the radiocapitellar joint (Video 1).

Posterolateral rotatory instability can be diagnosed arthroscopically by visualizing the radiocapitellar joint from the posterior compartment with the arthroscope positioned in the posterior lateral gutter. While maintaining the view of the radiocapitellar joint from this posterolateral gutter viewing perspective and with 90° of elbow flexion, maximal supination of the forearm will demonstrate posterior subluxation or even dislocation of the radial head when posterolateral rotatory instability is present. Proximal radioulnar joint instability may also be appreciated using this same arthroscopic technique and posterior gutter viewing perspective (Figs 5, 6).

Treatment of the identified pathology can then be performed, as indicated, which may include debridement, loose body removal, and arthroscopically assisted or open ligamentous repair or reconstruction. Restoration of adequate stability after lateral ulnar collateral ligament repair or reconstruction can also be confirmed arthroscopically after the elbow stabilization procedure is completed.

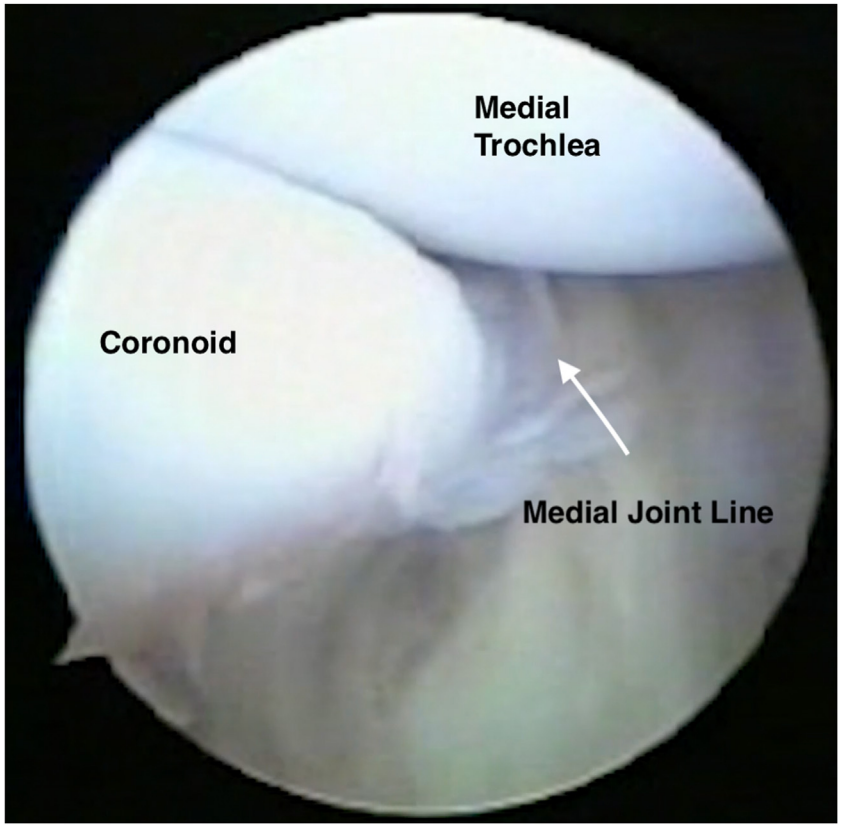

Fig 1. Arthroscopic image of a right elbow anterior compartment viewed through an anterolateral portal in the prone position showing a reduced medial ulnohumeral joint.

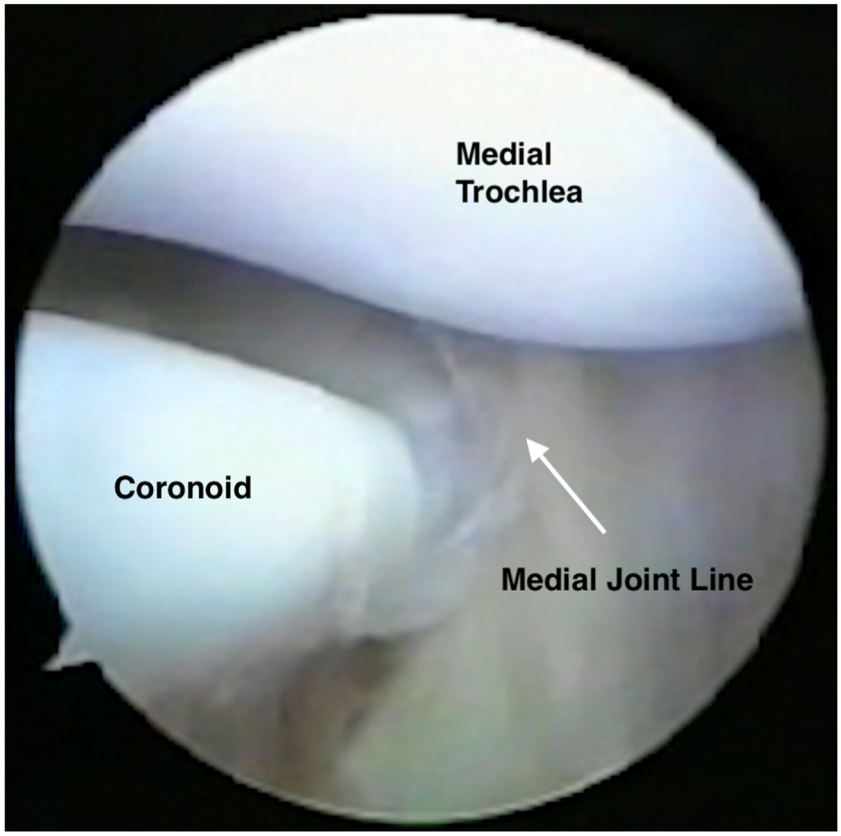

Fig 2. Arthroscopic image of a right elbow anterior compartment viewed through an anterolateral portal in the prone position, showing pathologic opening of the medial ulnohumeral joint during an arthroscopic valgus instability test.

Discussion

Accurately identifying the presence and degree of elbow instability is challenging. History and physical examination can provide critical information to physicians in such cases. Painful clicking, clunking, or even locking of the elbow is suggestive of instability. A history of trauma, activities predisposing to overload injuries, reports of a symptomatic portion of their arc of motion, or reproducible provocative maneuvers can help guide treatment. Unfortunately, as is often the case, patients may not be able to accurately articulate these sensations to treating physicians. Clinical examination maneuvers such as the lateral pivot-shift test, posterolateral rotatory drawer test, or stand-up test are also helpful for assessing posterolateral rotatory instability, whereas the moving valgus stress test can be very helpful in recognizing valgus instability.[3] The physical examination for such patients can also be nonspecific because stress fractures, tendinosis, and impingement may mimic instability on physical examination and may even be found concomitantly in cases of elbow instability.[2]

Obtaining diagnostic stress radiographs in cases of subtle elbow instability can be valuable. O'Driscoll[3] has recommended the use of fluoroscopic imaging, when available, and has described a reproducible technique for obtaining diagnostic stress imaging in the clinic, specifically when evaluating for posterolateral rotatory instability. He has also suggested the utility of diagnostic arthroscopy for cases of subtle instability.[3]

Magnetic resonance imaging and, more specifically, magnetic resonance arthrography serve as the gold standard for diagnosing soft tissue injuries, but these tests do not allow for a dynamic assessment of the medial and lateral structures of the elbow. Stress ultrasonography, however, is an option for surgeons and patients that allows for dynamic evaluation of these structures. However, it is user dependent and requires the ability to obtain the image while a provocative stress is applied, which can be difficult in the awake patient.

The senior author has previously published on the value of diagnostic arthroscopy in a cadaveric model for objectively evaluating medial elbow instability using the arthroscopic valgus instability test. This cadaver study reported pathologic medial ulnohumeral joint opening of 1 to 2 mm when complete transection of the anterior bundle was carried out. However, in this study, no significant opening was seen arthroscopically when only partial transection of the anterior bundle was performed. Valgus instability was also seen in this study

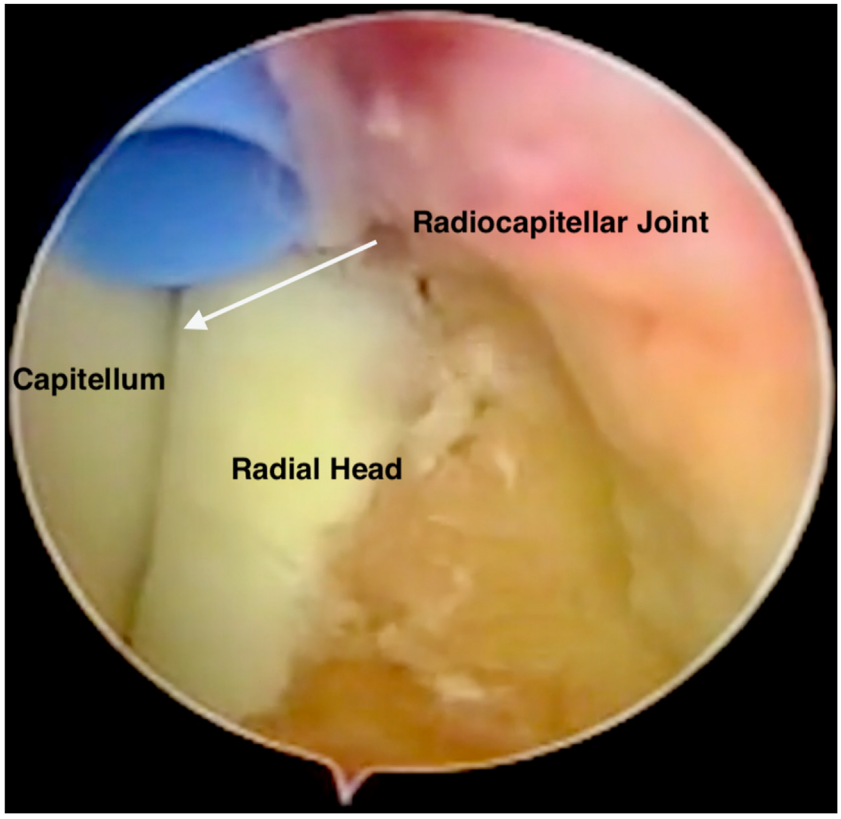

Fig 3. Arthroscopic image of a left elbow anterior compartment viewed through an anteromedial portal in the prone position showing a reduced radiocapitellar joint.

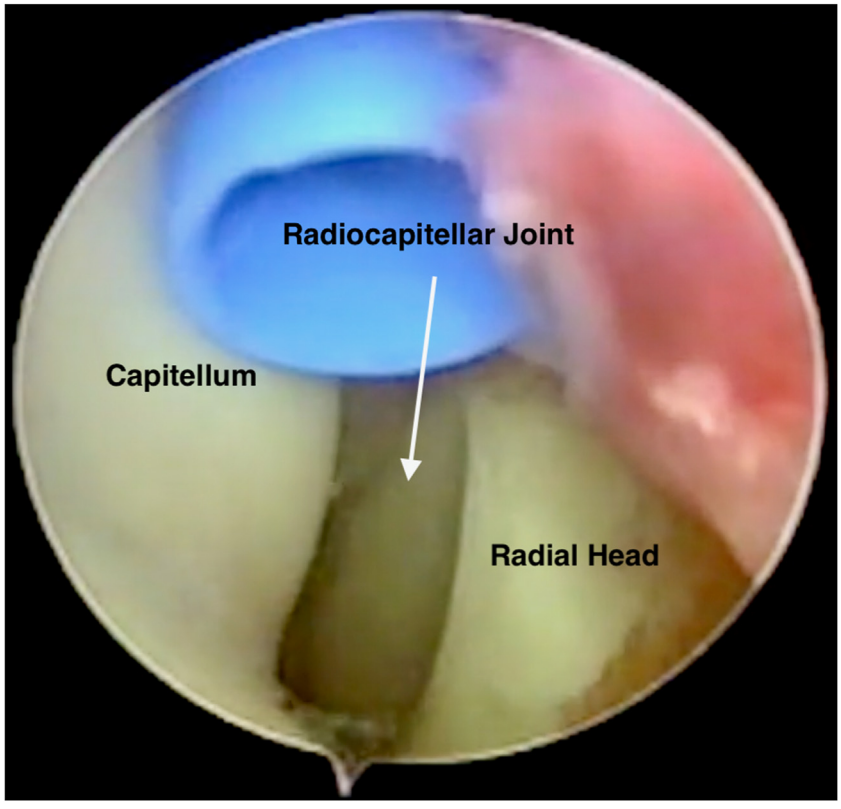

Fig 4. Arthroscopic image of a left elbow anterior compartment viewed through an anteromedial portal in the prone position showing pathologic opening of the radiocapitellar joint during varus stress of the elbow.

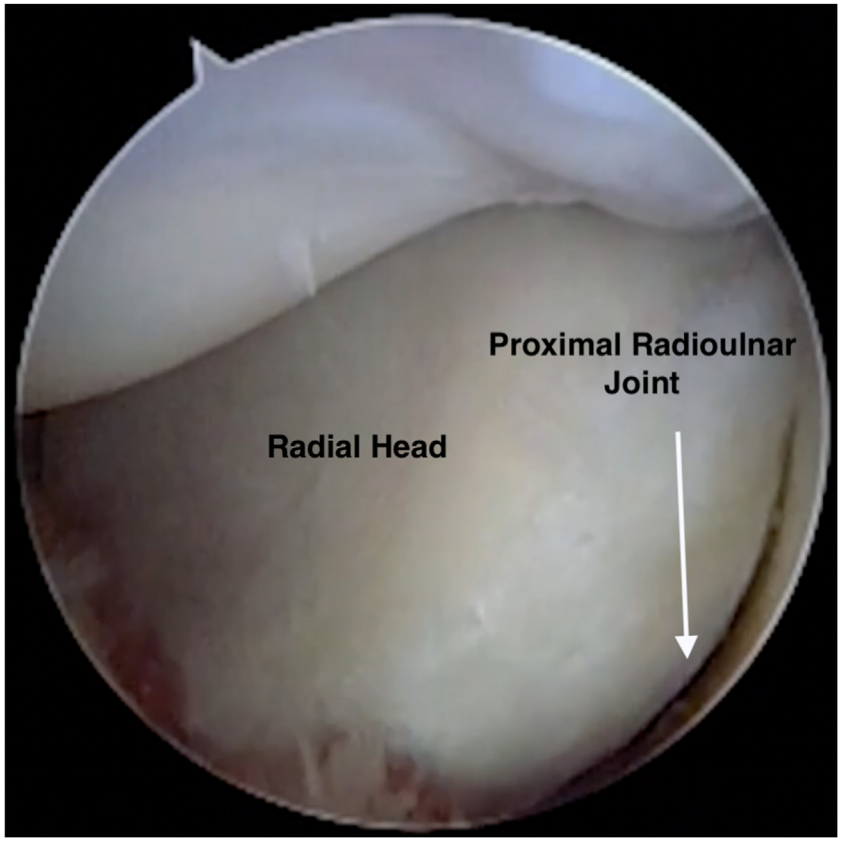

Fig 5. Arthroscopic image of a left elbow posterolateral gutter viewed through a posterior portal showing a reduced proximal radioulnar joint.

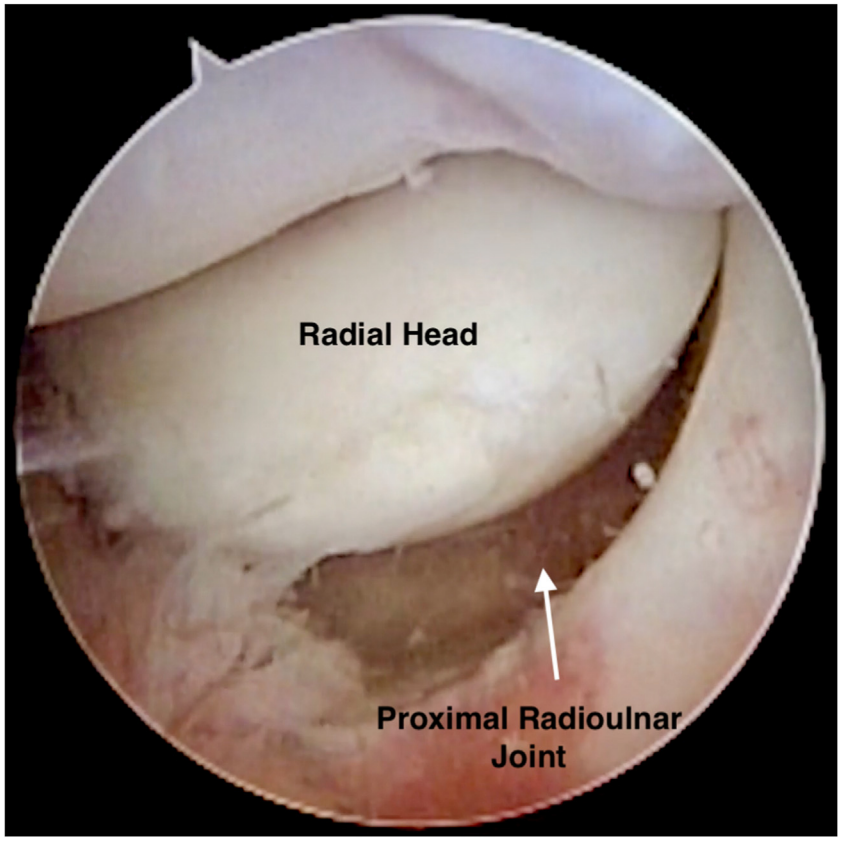

Fig 6. Arthroscopic image of a left elbow posterolateral gutter viewed through a posterior portal showing subluxation of the radial head from the proximal radioulnar joint occurring with supination of the forearm.

to be greatest at 70° of flexion after complete transection of the anterior and posterior bundles.[4]

Plath et al.[5] also presented an arthroscopic technique to objectively recognize and quantify lateral-sided elbow instability with the use of arthroscopic rods of increasing diameter into the radiocapitellar and ulnohumeral joints. They found that >6 mm of ulnohumeral and >7 mm of radiohumeral joint space opening indicated a lateral collateral ligamentous complex lesion, although they were unable to differentiate between radiohumeral ligament or lateral ulnar collateral ligament lesions. They also found that opening >9 mm is indicative of complete lateral ulnar collateral capsuloligamentous complex tear. Their data also reported superior inter-rater and test-retest reliability when compared to stress ultrasound scanning.[5]

All modalities that are used to diagnose elbow instability have their respective advantages and disadvantages. The authors present 3 reproducible arthroscopic techniques that are valuable in identifying and quantifying elbow instability. Despite the invasive nature of arthroscopy in comparison to modalities such as ultrasonography and radiography, these described techniques provide safe and objective means to evaluate and diagnose both medial and lateral elbow instability. Because the limitations of this technique are the same as those for basic diagnostic arthroscopy, these techniques can assist elbow surgeons of all skill levels, while offering therapeutic benefits in the form of arthroscopic assisted ligamentous repair or reconstruction to more experienced elbow surgeons.

References

1. Savoie FH 3rd, O'Brien MJ, Field LD, Gurley DJ. Arthroscopic and open radial ulnohumeral ligament reconstruction for posterolateral rotatory instability of the elbow. *Clin Sports Med* 2010;29:611-618.
2. Arrigoni P, Cucchi D, D'Ambrosi R, Menon A, Aliprandi A, Randelli P. Arthroscopic R-LCL plication for symptomatic minor instability of the lateral elbow (SMILE). *Knee Surg Sports Traumatol Arthrosc* 2017;25:2264-2270.
3. O'Driscoll SW. Classification and evaluation of recurrent instability of the elbow. *Clin Orthop Relat Res* 2000;370:34-43.
4. Field LD, Altchek DW. Evaluation of the arthroscopic valgus instability test of the elbow. *Am J Sports Med* 1996;24:177-181.
5. Plath J, Otto A, Förch S, et al. Arthroscopic rod technique compared to stress ultrasound in the dynamic evaluation of lateral ligament instabilities of the elbow. *Arch Orthop Trauma Surg* 2023;143:2087-2093.