Technical Note

Arthroscopic Repair of Extensor Carpi Radialis Brevis in Patients With Tennis Elbow

Zhang Hailong, M.D., Ph.D., and Lu Yi, M.D., Ph.D.

Abstract: Lateral epicondylitis, or tennis elbow, has been attributed to the degeneration of the extensor carpi radialis brevis tendon, with surgery reserved for recalcitrant cases. Surgical intervention of lateral epicondylitis includes release alone or release with repair. Outcomes of open surgical repair have been reported with better preservation of the grip strength than release alone. We describe a technique for the release and repair of the extensor carpi radialis brevis tendon using an arthroscopic approach, which could be used to repair the extensor carpi radialis brevis with minimal invasion and to address the concomitant intra-articular pathology.

Lateral epicondylitis, the most common cause of lateral elbow pain, has been attributed to the overuse to the extensor carpi radialis brevis (ECRB), which results in degeneration of the ECRB tendon.[1] Patients with lateral epicondylitis typically present with pain over the lateral epicondyle that is exacerbated by wrist extension and forearm supination. Physical examination reveals tenderness at the lateral epicondyle and pain with resisted wrist extension. Although the diagnosis of lateral epicondylitis can be made on the basis of the clinical appearance, high-intensity signal at the ECRB tendon on a T2 sequence of magnetic resonance imaging may offer additional supportive evidence.[2] Concomitant pathology at the lateral elbow that may be present should be elicited, including lateral plica syndrome, radiocapetellar joint arthritis, and posterolateral rotatory instability.[3,4] These conditions could be differentiated by detailed history taking, careful physical examination, and appropriate imaging modality.

In most cases, lateral epicondylitis is regarded as a self-limiting condition, and conservative measures have been reported to be beneficial.[5-10] However, there were still 10% of patients who are unresponsive to conservative treatment and require surgical treatment.[11] In the literature, several surgical techniques have been proposed.[12-14] However, the optimal surgical treatment has been the subject of controversy. Recently, arthroscopic ECRB release has become a more popular and accepted technique as a result of its less-invasive nature and treatment of the concomitant intra-articular pathology.[15] Despite the considerable achievement in the treatment of lateral epicondylitis by release, a failure rate of 15% was reported as a result of loss of function, especially loss of grip strength, which was attributed to no reattachment of the ECRB tendon back to the lateral epicondyle.[16-18]

We present a surgical technique involving arthroscopic release followed by repair of the ECRB using a suture anchor. We believe this allows for maximum preservation of grip strength and treatment of the concomitant pathology in a mini-invasive fashion.

Surgical Technique

Preoperative Assessment and Patient Positioning

The research protocol was approved in advance by the appropriate ethical committee in line with the Declaration of Helsinki. All procedures were performed in compliance with relevant laws and institutional guidelines and have been approved by the institutional review board (July 5, 2021; 20220571). Informed consent was obtained from the patients. Patients were diagnosed with lateral epicondylitis from the history

From the Department of Sports Medicine, Beijing Jishuitan Hospital Affiliated to Capital Medical University, Beijing, China. The investigation was performed at Beijing Jishuitan Hospital, Beijing, China.

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Address correspondence to Lu Yi, M.D., Ph.D., Department of Sports Medicine, Beijing Jishuitan Hospital Affiliated to Capital Medical University, No. 31 Xinjiekou East St., Xicheng, Beijing 100035, China. E-mail: luyi_sports@126.com

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and physical examination, which was confirmed by increased signal of ECRB in magnetic resonance imaging.

The intervention is performed with the patient in the lateral decubitus position with the affected elbow at 90° of flexion (Fig 1A). After brachial plexus block anesthesia is induced, a nonsterile tourniquet is applied with the ischemia time less than 2 hours. Fluid inflow is controlled by gravity and no pump is used.

Portal Placement

The procedure is undertaken with 4 portals as well as an incision for suture anchor placement. First, the standard posterior portal is created at the soft spot (Fig 1B). Then, an accessory posterolateral portal is established one finger-breadth lateral to the standard posterior portal at the level of the radiocapitellar joint with the guidance of a spinal needle under arthroscopic supervision. These 2 portals are combined for inspection of pathology at the posterolateral compartment. The anterior compartment could be explored via the proximal anteromedial and anterolateral portals, which are located 2 cm proximal and anterior to the medial and lateral epicondyle, respectively. If visualization is a problem, a retractor can be introduced through an anteromedial portal 2 cm anterior to the medial epicondyle (Fig 1C). An additional incision, 1 cm in length, is made at the lateral epicondyle (Fig 1D). This pilot hole is designed for suture anchor placement and subsequent ECRB repair.

Arthroscopic Diagnosis

A 30° arthroscope is introduced through the posterior portal, and synovectomy is performed by shaver through the accessory posterolateral portal when necessary (Video 1). A full intra-articular joint inspection is performed, and concomitant hypertrophied lateral plica or injury of the lateral ulnar collateral ligament can be addressed if required. Then, the arthroscope is passed into the anterior compartment through the triangle formed by the humerus, radius, and ulna, and the proximal anteromedial portal and anteromedial portal are established under direct arthroscopic supervision. A switching rod and retractor are placed into the proximal anteromedial portal and anteromedial portal, respectively (Fig 2). The arthroscope is introduced into the anterior compartment with the switching rod. By tensioning the capsule anteriorly with the retractor, improved visualization of the lateral capsule can be achieved. Intra-articular pathology is documented, and the alterations of the capsular tissue at the insertion area of the ECRB tendon are classified (Fig 3). Next, the shaver is introduced into the anterior compartment after establishment of the proximal anterolateral portal, and the lateral capsule is released from the humeral origin to fully expose the ECRB tendon. Suction should not be used to decrease the risk of collapse of the anterior capsule and neurovascular damage.

Passage of Guidance Suture and Suture Anchor Placement

After appreciation of the ECRB tendon, 3 guidance sutures are passed through the ECRB tendon. A spinal needle cannula loaded with a polydioxanone (PDS) suture (Ethicon, Somerville, NJ) is introduced into the proximal anterolateral portal and pierces the ECRB tendon. The PDS is pulled out through the soft spot portal using a suture retriever. The shuttle relay is made by connecting the PDS with a high strength suture and is then pulled out through the proximal anterolateral portal. Two more sequences are repeated with the passage of the ECRB tendon to make the distribution of

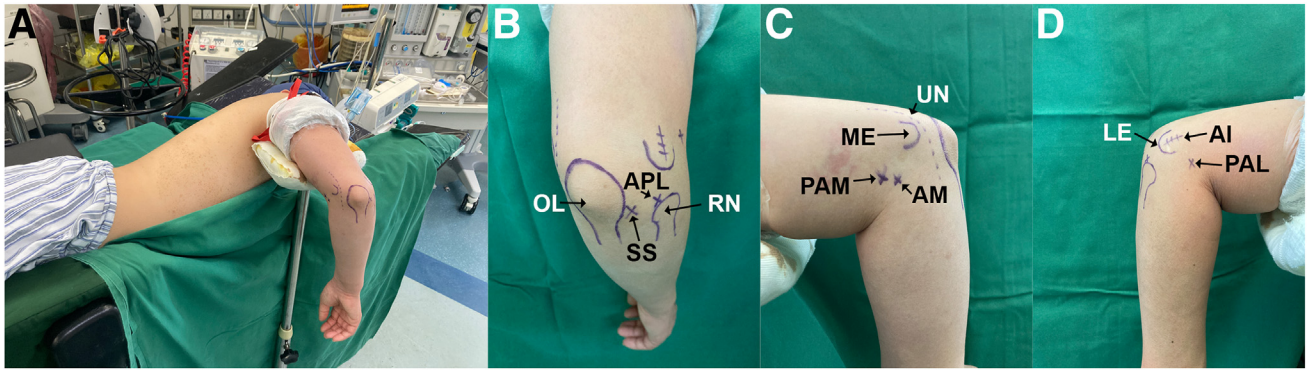

Fig 1. (A) The patient is placed in the lateral decubitus position with the right arm resting on the holding board. (B) Posterior aspect of the right elbow. Establishment of soft spot (SS) portal and accessory posterolateral (APL) portal. (C) Medial aspect of the right elbow. Establishment of proximal anteromedial (PAM) portal and anteromedial (AM) portal. (D) Lateral aspect of the right elbow. Establishment of additional incision (AI) and proximal anterolateral (PAL) portal. (LE, lateral epicondyle; ME, medial epicondyle; OL, olecranon; RN, radial head; UN, ulnar nerve.)

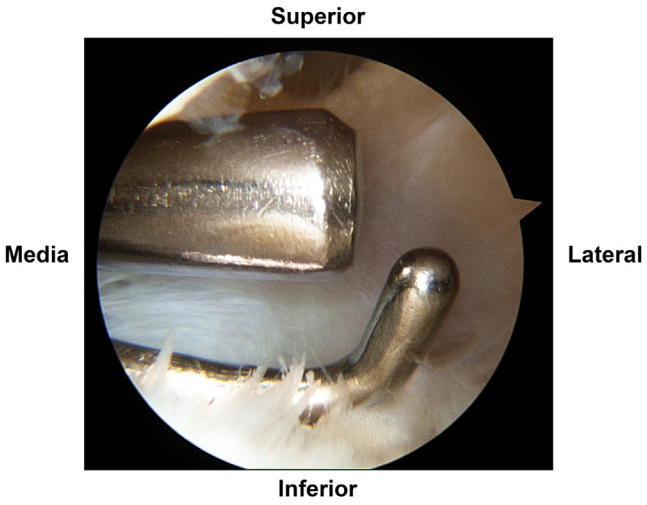

Fig 2. Arthroscopic view of the anterior compartment of the right elbow with the scope in soft spot portal. Switching rod and probe are inserted from proximal anteromedial portal and anteromedial portal separately. The probe serves as a retractor for better visualization of the anterior compartment in subsequent procedure.

the guidance suture in the configuration of an inverted triangle (Fig 4).

An additional incision is made and a 3.0-mm drill bit with guide is used to create a pilot hole on the lateral epicondyle. A 3.5-mm-diameter titanium suture anchor with double-loaded thread (HealFix; REJOIN, Hangzhou, China) is inserted into the lateral epicondyle. Fluoroscopic image intensifier is used to verify the position of the suture anchor.

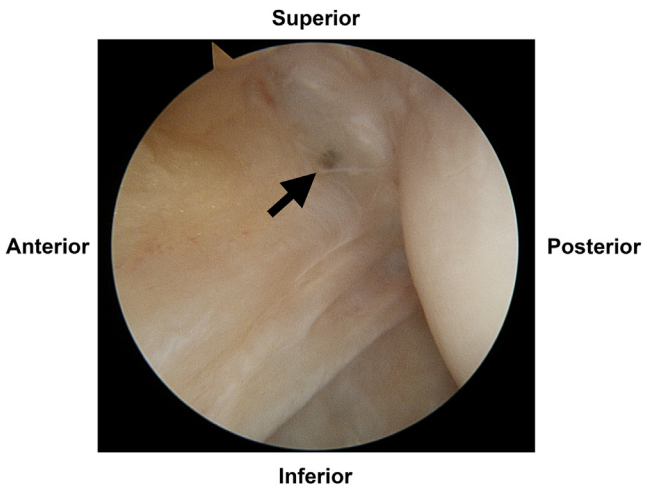

Fig 3. Arthroscopic view of anterolateral aspect of the anterior compartment of the right elbow with the scope in proximal anteromedial portal. Fissure in the lateral capsule indicated by the arrow is identified, which is associated with lateral epicondylitis.

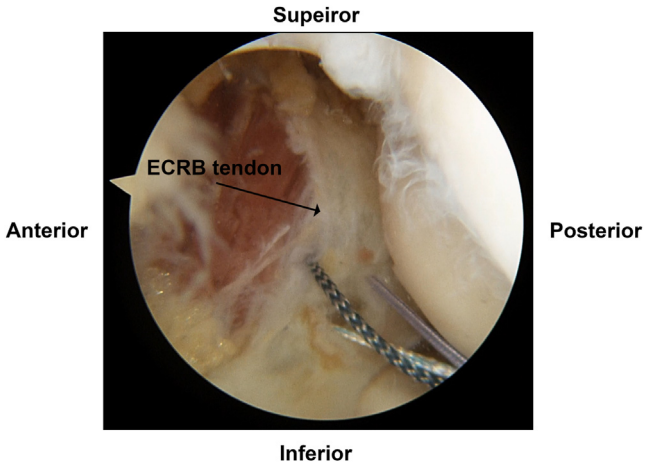

Fig 4. Arthroscopic view of anterolateral aspect of the anterior compartment of the right elbow with the scope in proximal anteromedial portal. Lateral capsule has been removed to expose the ECRB tendon with 3 guidance sutures passing through the ECRB tendon. (ECRB, extensor carpi radialis brevis.)

Repair of Extensor Carpi Radialis Brevis

The ECRB tendon is released from the proximal origin at the lateral epicondyle with radiofrequency through the proximal anterolateral portal and the entire ECRB will retract distally away from the humerus (Fig 5). The bony bed for reattachment is prepared with a burr.

The suture retriever is inserted into the anterior compartment through the addition incision and is used to retrieve one limb of the guidance suture. The shuttle relay is made to guide one suture from the anchor

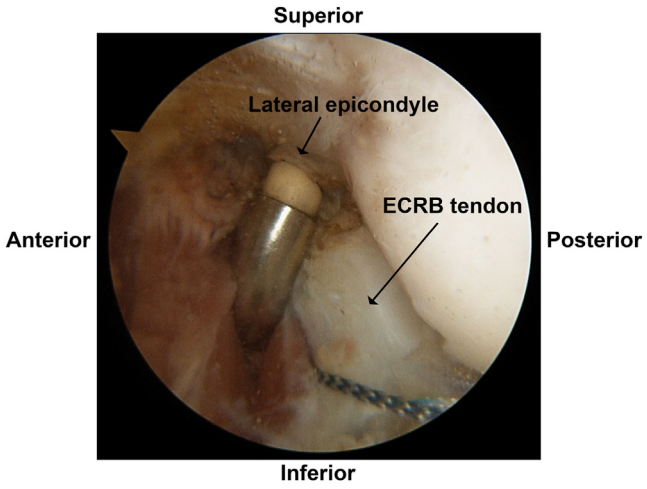

Fig 5. Arthroscopic view of anterolateral aspect of the anterior compartment of the right elbow with the scope in proximal anteromedial portal. The ECRB tendon is detached from lateral epicondyle using radiofrequency ablation probe from proximal anterolateral portal. (ECRB, extensor carpi radialis brevis.)

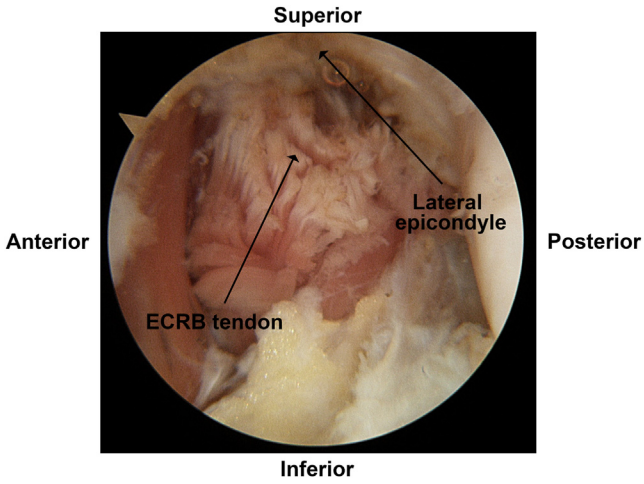

Fig 6. Arthroscopic view of anterolateral aspect of the anterior compartment of the right elbow with the scope in proximal anteromedial portal. The ECRB tendon is reattached to its origin at lateral epicondyle. (ECRB, extensor carpi radialis brevis.)

passing the ECRB tendon. Two more sequences are repeated to make paired strands of one thread and one strand of the other thread passing through the ECRB tendon separately. The single strand of thread is pulled out through the additional incision using the suture retriever, and a knot pusher could be helpful in case of difficult identification of the strand. The knot is tied in the modified Mason–Allen method and the stump of the ECRB is reattached to the lateral epicondyle (Fig 6).

Postoperative Care

Postoperatively, the upper limb is immobilized within a brace for 1 week. Active range-of-motion exercises for the shoulder and digits are encouraged on 1 day postoperatively. Formal physical therapy is initiated at 1 week when the brace is removed. Active range-of-motion exercises for the elbow are performed until 3 weeks after surgery and resistance commences at the earliest after 6 weeks, with the expectation of full recovery at 3 months from the index surgery.

Table 1. Advantages and Disadvantages of Arthroscopic Extensor Carpi Radialis Brevis Repair

Advantages
The ECRB tendon is reattached to its origin on the lateral epicondyle, which allows tendon restoration and is associated with clinical improvement in grip strength.
The arthroscopic technique allows for evaluation of intra-articular condition and treatment of concomitant pathology.
Only the ECRB tendon is released and reattached while violation of extensor aponeurosis is avoided.
Disadvantages
Implant cost of including an anchor for fixation. Radiographic confirmation of the anchor position.

ECRB, extensor carpi radialis brevis.

Table 2. Surgical Pearls and Potential Pitfalls of Arthroscopic Extensor Carpi Radialis Brevis Repair

Peasrls
Careful evaluation of the radiocapitellar joint with adequate excision of the hypertrophic plica and restoration of the tension of the lateral ulnar collateral ligament if necessary.
A retractor could be used to improve the visualization of the anterior compartment.
Ensure that adequate ECRB tendon is released to unload the inflammatory tissue.
The direction of the drill bit is angled 45° cephalically in the horizontal plane to minimize the risk of penetration into the joint.
Have the anchor immediately available for insertion and maintain the drill guide position during anchor insertion.
Pitfalls
Avoid injury to the lateral collateral ligament when releasing the ECRB tendon from the lateral epicondyle.
Beware of the radial nerve just anterior to the radial head when the capsule is cleared in the anterior compartment.
Careful suture management to ensure that only the ECRB stump is reattached and ECRL is not involved during knot tying.

ECRB, extensor carpi radialis brevis.

Discussion

The prevalence of lateral epicondylitis is 1% to 3% in adults but can significantly impair the function in athletes as well as laborers.[19] Most cases can be successfully treated with conservative treatment, and surgical intervention is reserved for recalcitrant cases unresponsive to conservative management.

The described surgical techniques include open or arthroscopic release of the ECBR tendon, both of which have proven to be successful regarding relieving pain and improving functionality.[20] The advantages of the arthroscopic technique include better evaluation of the joint pathology and a faster rehabilitation, thus gaining increasing popularity in the surgical management of lateral epicondylitis. However, there is still a failure rate of 15%, with persistent pain and loss of function, which is attributed to no reattachment of the ECRB tendon back to the lateral epicondyle. Nirschl and Pettrone were the first investigators to report on the outcome of surgical treatment of lateral epicondylitis with open debridement and primary repair, and 85% of patients returned to full preinjury activity.[1] Thornton et al.[21] retrospectively reviewed surgical cases of recalcitrant lateral epicondylitis and reported that the increase in grip and pinch strength was up to 106% compared with the contralateral upper limb after reattachment. Monto[17] compared the outcome between groups of reattaching the ECRB with suture anchor and debridement only in open procedure, and their finding showed better results favoring reattaching the ECRB tendon.

We prefer our technique of arthroscopic release of the ECRB tendon followed by reattaching the ECRB tendon

to the lateral epicondyle using a suture anchor (Table 1). Pearls and pitfalls of the procedure are summarized in Table 2. This arthroscopic technique allows the surgeon to release and reattach the ECRB tendon in a less-invasive fashion and treat the concomitant intra-articular pathology when necessary. Our technique also describes a method of reattaching the ECRB tendon without violation of the superficial extensor aponeurosis, which may not be achieved by open procedures.

Disclosures

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