Technical Note

Arthroscopic Repair for the Anterior Horn of the Lateral Meniscus With Suture Anchor

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Abstract: The anterior horn tear of the lateral meniscus, often accompanied with local parameniscal cysts, is usually managed by cysts debridement and meniscus repair with the outside-in technique (OIT). However, a big gap between the meniscus and anterior capsule would be produced after cysts debridement and be difficult to be closed by the OIT. Or, the OIT would result in knee pain because of the overly tight knots. Therefore, we devised an anchor repair technique. Following the cysts resection, the anterior horn of the lateral meniscus (AHLM) is fixed at the anterolateral edge of the tibial plateau with 1 suture anchor, and then followed by suturing the AHLM with the surrounding synovium to promote healing. We recommend this technique as an alternative method for repairing an AHLM tear accompanied with local parameniscal cysts.

Introduction

The tear of the anterior horn of the lateral meniscus (AHLM), especially the horizontal tear patter, is usually accompanied with anterolateral parameniscal cysts and usually were treated by the arthroscopic cystectomy and AHLM repair with outside-in technique (OIT).[1,2] After cysts debridement, a big gap between the AHLM and anterior capsule would be difficult to be closed by the OIT, which might result in high tension on anterior capsule and cause knee pain.[3]

In this study, we propose a technique to restore the AHLM stability with a suture anchor after resecting the parameniscal cysts. And then the lateral meniscus and synovium are sutured with one stitch to increase the vascular supply to the meniscus and promote the healing.

Surgical Technique

Preoperative Evaluation and Indications

The cases with AHTLM concomitant parameniscal cysts could be diagnosed by physical examinations, magnetic resonance imaging (MRI), and knee arthroscopy. The cases with the following findings are enrolled for this technique: 1) complete reparable tear of AHLM concomitant parameniscal cysts and 2) in younger (<50 years) patients without preexisting arthritis (ICRS < 3). The cases with the following conditions were excluded: 1) patients with significant malalignment in lower limb, as well as severe osteoarthritic changes; 2) radial tear pattern or macerated tear pattern, which is irreparable; 3) joint infection; and 4) systemic joint synovitis.

Institutional review board approval was obtained before we initiated the study. All patients provided written informed consent.

Diagnostic Arthroscopy

The patient is placed on the operating table in the supine position with general anesthesia. A tourniquet is

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placed high around the proximal thigh and inflated during the operation. A higher anterolateral portal is located 1-1.5 cm above the joint line and at the lateral edge of the patellar tendon in a palpable soft spot. The anteromedial portal is made through an arthroscopic view from the anterolateral portal. With the knee at the figure-of-four position, the tear pattern and tissue quality of AHLM and the concomitant parameniscal cysts are observed using a 30° scope.

Step-by-Step Procedure

Cysts Resection

With viewing from the anteromedial portal (Video 1), the parameniscal cysts could be observed (Fig 1A) and released from its surrounding adhesion using a shaver (3.5-mm Cuda; ConMed) or a coblation wand (Super Multivac 50; Arthrocare, Smith & Nephew) through the anterolateral portal (Fig 1B). The anterolateral margin of tibial articular surface is prepared using a burr (4.0-mm Oval Burr; ConMed) to freshen the cancellous bone bed.

Anchor Fixation

Through the anterolateral portal, the loop of a folded FiberWire (2#, Arthrex) is introduced and sent into the joint beneath the AHLM, and then is pulled out above the AHLM. The 2 free suture limbs are passed through the suture loop and pulled to produce a holding around AHLM (Fig 1C). Finally, the suture strands are secured on the anterior margin of the lateral tibial plateau (Fig 1, D and E) with a PushLock (3.5 mm; Arthrex) to fix the AHLM.

One-Stitch Sutures the AHLM With Surrounding Synovium

A no. 2 nonabsorbable suture (Ethibon 4843, Sommerville, NJ) is delivered into the joint through a spinal needle penetrating the AHLM and its anterior synovium. The needle is withdrawn with the suture free end held. The two suture strands are pulled out and tied from the anterolateral portal. The anterior edge of

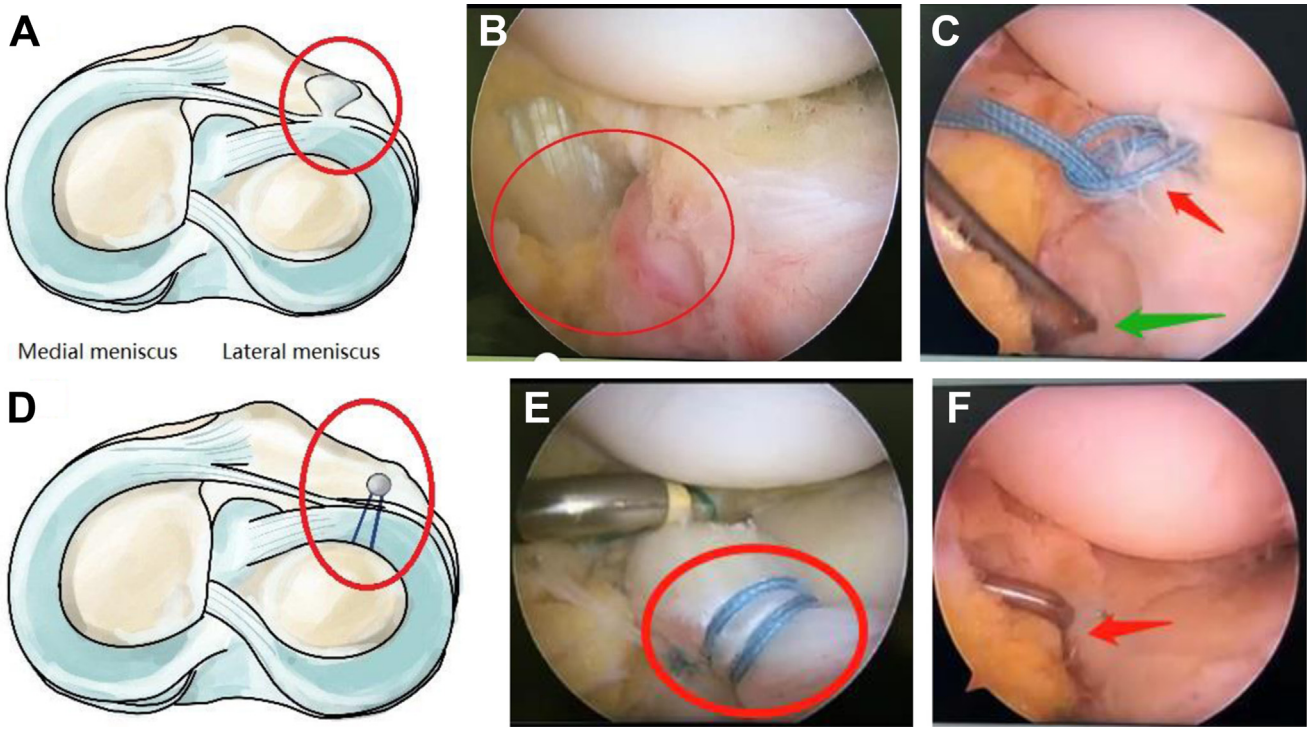

Fig 1. (A) Axial images: the anterior horn of the lateral meniscus tear accompanied with an anterolateral parameniscal cysts (red circle). (B) The patient is in a supine position, with right knee at the figure-of-four position. Arthroscopic photograph shows the cystectomy and the meniscus front was separated from the joint capsule (red circle). (C) The patient is in a supine position, with right knee at the figure-of-four position. Through the anterolateral portal, the loop of a folded FiberWire (2#, Arthrex) is introduced and sent into the joint beneath the anterior horn of the lateral meniscus (AHLM), and then is pulled out above the AHLM. The 2 free suture limbs are passed through the suture loop and pulled to produce a holding around AHLM (red arrow). And then the suture anchor position is prepared on the anterior margin of the lateral tibial plateau (green arrow). (D) Axial images: anchor position (red circle). (E) The patient is in a supine position, with right knee at the figure-of-four position. The AHLM was rigidly tied on the tibial plateau articular cartilage margin surface with a PushLock (3.5 mm; Arthrex) to fix the AHLM (red circle). (F) The patient is in a supine position, with the right knee in a figure-of-four position. The AHLM was sutured together with the synovium. The stability of meniscal repair is determined with the arthroscopic probe (red arrow).

Table 1. Pearls and Pitfalls of Critical Surgical Steps

Surgical Step	Pitfalls	Pearls
Assessment of the articular cartilage	A patient with OA worse than expected should be excluded.	In patients with moderate knee joint OA, in addition to an AHLM repair, the source of the OA must be treated to achieve a satisfactory outcome.
Assessment of the meniscus tear pattern	Radial tear pattern or macerated tear pattern, which is irreparable should be excluded.	Tear pattern examination should be done to check if a meniscus lesion could be repaired, after which repairs should be done. A shaver is inserted to trim away the margin of the tear site and encourage healing.
Cystectomy	Incomplete cystectomy	Completely incision of the parameniscal synovium
Insertion of the anchor	Improper position of the anchor may cause anchor pullout, iatrogenic fractures, or improper repair of torn meniscus.	Confirmation the proper position beside the articular cartilage edge 5 mm for the fixation of the AHLM.
Suture the AHLM and synovium	Insecure suture, knot tying between AHLM and joint capsule	Knot tying should be solid to make sure the AHLM was sutured together with the synovium and not entrap the capsular

AHLM, anterior horn of the lateral meniscus; OA, osteoarthritis.

AHLM is sutured together with the synovium. The stability of meniscal repair is determined with the arthroscopic probe (Fig 1F and Table 1).

Postoperative Rehabilitation

Postoperative treatment is vital for the rehabilitation. Toe-touch weight bearing is allowed in brace locked in extension for 0−2 weeks. After 2 weeks, partial weight bearing is gradually transitioned to full weight bearing. 0−90° range of motion (ROM) is allowed immediately when non-weight bearing. From 4 weeks, the brace is removed, and full weight bearing is allowed with 0−120° ROM. Squatting beyond 120° and cutting sports are allowed after 3 months. Straight leg raising exercises are continued for 3 to 6 months postoperatively depending on the progress of the individual patient.

Table 2. Advantages and Disadvantages of Repair of AHLM Tear Concomitant Parameniscal Cyst by One Stitch Combined With Anchor

Advantages
1. This technique can be performed in AHLM tear concomitant parameniscal cyst.
2. The parameniscal cysts can be completely incision without consideration of the separation of the AHLM and synovium.
3. Fixation the AHLM on the tibial plateau articular cartilage margin surface can maintain the meniscal stability.
4. One stitch suture can reduce operation time and risk of iatrogenic injuries.
5. Suture the AHLM and the synovium can preserve vascular supply which may improve the healing progression of the AHLM repair.

Disadvantages
1. This technique should use a suture anchor.
2. This technique is not available to patients with poor-quality meniscus.
3. This technique is not available for severe OA.

AHLM, anterior horn of the lateral meniscus; OA, osteoarthritis.

Discussion

The AHTM tear, especially in the horizontal pattern, is usually accompanied with cysts.[4] How to manage cystectomy and repair AHLM is challenging. In this study, we propose a complete cystectomy and anchor fixation the AHLM and suture the surrounding synovium with the AHLM, which can manage the AHTLM accompanied with cysts.

As we know, the integrity of the AHLM greatly influences joint mechanics. A tear of the AHLM demonstrates a significant increase in tibiofemoral peak forces in both the medial and lateral compartments. With repair, the preinjury condition peak forces are restored to normal, suggesting the importance of repairing tears of the AHLM.[5] In this study, we propose an anchor fixation to repair the AHLM, which can preserve the integrity of the AHLM structure.

The treatment for the AHTLM and parameniscal cysts is mandatory by arthroscopic surgery. To protect the meniscus stability, parameniscal synovium resection can be incompletely performed, and the recurrence of the parameniscal cysts is inevitable.[6] In this study, for the meniscus fixation, we can do the cystectomy completely. Combined with a one-stitch suture, the AHLM with surrounding synovium technique, vertical mattress suture on the meniscus, and the synovium can preserve the vascular supply, which may improve the healing progression of the AHLM repair. Therefore, this technique allows a complete cysts resection without preserving the parameniscal synovium.

For repairing of the AHLM, the outside-in technique has been widely used. Rodeo[7] reported that the outside-in technique was especially useful for suturing the AHLM. Because the AHLM is located more posteriorly than that of the medial meniscus,[8] The lateral

meniscus also has fewer capsular attachments and more free movement,[9] so that during knee flexion the meniscus pulls backward.[10] If extra-articular knot tying is undertaken, the normal anatomy and biomechanics may be changed and abnormal knot tension between the meniscus and the joint capsule, or pain due to joint capsule entrapment, might occur. To overcome these disadvantages, we use an anchor to fix the AHLM on the tibia plateau. During knee movement the meniscus doesn't shift due to the traction of capsule. Generally, only 1 knotless anchor can securely fix the AHLM on the tibial plateau. The application of knotless anchor can avoid the knot wear the articular cartilage.

Anchor fixation for the meniscus repair is not suitable for the radial tear pattern or macerated tear pattern, which is irreparable, and severe OA. Firstly, arthroscopic anchor repair of the AHLM aims to preserve the intact meniscus structure; however, the radial tear pattern or macerated tear pattern is irreparable. Second, the purpose of meniscus repair is to protect the articular cartilage; therefore, this technique is not suitable for patients with severe OA.

In conclusion, this technique has several advantages. Therefore, we recommend this technique as an alternative repairing method for tears of the AHLM accompanied with parameniscal cysts (Table 2). The preliminary results with this technique show satisfactory clinical outcomes and improved clinical scores.

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