Technical Note

How To Avoid Suture Damage in Simultaneous Anterior Cruciate Ligament Reconstruction and Lateral Meniscal Posterior Root Reinsertion With the Transtibial Pullout Technique: A Technical Note

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Abstract: Lateral meniscus posterior root tears (LMPRTs) are estimated to occur in 7% to 12% of anterior cruciate ligament (ACL)-injured knees. This topic is of great interest because of their biomechanical consequences in terms of interruption of hoop stress distribution. If left unrepaired, the corresponding compartment is exposed to unfavorable contact dynamics, similar to those resulting from a total meniscectomy. This Technical Note describes a transtibial LMPRT repair using a Knee Scorpion and an 18-gauge spinal needle. It is a reproducible arthroscopic LMPR reinsertion technique combined with concomitant standard ACL + anterolateral ligament reconstruction with hamstring tendons and it describes how to safely avoid damage to root traction sutures during the ACL independent tibial tunnel drilling.

Lateral meniscus posterior root tears (LMPRTs) are estimated to occur in 7% to 12% of anterior cruciate ligament (ACL)-injured knees.[1,2] It has been shown that LMPRTs increase anterior tibial translation and pivot shift in concomitant ACL rupture.[3] This injury is defined by an avulsion tear of the posterior root insertion site or an injury to the meniscotibial ligaments.

Root tears are of great interest because of their biomechanical consequences in terms of interruption of hoop stress distribution. If left unrepaired, the corresponding compartment is exposed to unfavorable contact dynamics, similar to those resulting from a total meniscectomy.[2,4,5] This is of particular significance in lateral tibiofemoral compartment, due to the convexity of the tibial plateau, leading to a much higher increase in tibiofemoral contact pressures comparing to similar lesions on the medial side.[6,7] LMPRT were subject to many classifications.[8] The combined ACL reconstruction and LMPR reinsertion is thought to be technically demanding because of the potential of tibial tunnels convergence and LMPR pullout suture damage during ACL tibial tunnel drilling.

Several LMPRT repair techniques have been described using suture anchor technique, all-inside technique, and transtibial technique.[8] This Technical Note describes a transtibial LMPRT repair using a Knee Scorpion (Arthrex, Naples, FL) and an 18-gauge spinal needle. It is a reproducible arthroscopic LMPR reinsertion technique combined with concomitant standard ACL + anterolateral ligament (ALL) reconstruction with hamstring tendons, and it describes how to safely avoid damage to root traction sutures during the ACL independent tibial tunnel drilling (Video 1). Pearls and pitfalls plus advantages and disadvantages are described in Tables 1 and 2.

Surgical Technique

Patient Setup

The patient is placed supine on the operating table in the standard arthroscopy position with a lateral post

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Table 1. Pearls and pitfalls of Technique for Lateral Meniscus Posterior Root Transtibial Repair

Pearls
Debride LMPR footprint before the ACL tibial tunnel
Place LMPR tibial tunnel slight lateral from the tibial ACLR tunnel
Use a classic tibial guide in an AM portal
Use a 2 mm K-wire to perform the LMPR tunnel
Use an 18-gauge spinal needle to introduce a no. 1 Ethilon loop (Arthrex, Naples, FL) (to pullout LMPR suture)
Use a suture passing device (Knee Scorpion; Arthrex) to suture the LMPRT
Pitfalls
LMPR suture should be pulled out through the tibial tunnel with slight tension to avoid it being cut

ACL, anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction; AM, anteromedial; LMPR, lateral meniscus posterior root; LMPRT, lateral meniscus posterior root tear.

just proximal to the knee, at the level of the padded tourniquet, and a foot roll to prevent the hip from externally rotating and to maintain 90° of knee flexion.

Graft Harvest

The hamstrings are harvested with an open-ended tendon stripper (Pigtail Hamstring Tendon Stripper, open end, 5 mm; Arthrex) through a 2- to 3-cm vertical incision over the pes anserinus distal insertion.

Arthroscopic Exploration, Tear Pattern Evaluation, and Minimal Notch Debridement

A full diagnostic arthroscopy is performed through a standard high lateral portal.[9] The lateral meniscus posterior root is evaluated with the knee in Cabot position, and an arthroscopic probe placed in the anteromedial portal is used to carefully assess the meniscal root and its attachment. Then a grasper is used to reduce the meniscal tear and evaluate the optimum suture location for anatomic tear reduction. Small root remnants and root avulsions are considered to be repaired through the transitibial pullout technique. The tibial footprint is prepared using a shaver, with extensive debridement of soft tissues down to a bleeding bone bed to improve healing potential of the repair. A minimal debridement of the femoral notch is then performed to expose the anteromedial (AM) bundle femoral footprint (Fig 1 A-C).

Table 2. Advantages and Disadvantages of the Technique

Advantages
Drilling a small LMPRT tunnel
Ease and accessibility of the instrumentation (2 mm K-wire, 18-gauge spinal needle)
Anatomical, reproducible, and safe technique
LMPR repair with small tunnel and simple material (18-gauge spinal needle and a No 1. Ethilon; Arthrex, Naples, FL)
LMPR repair without any further bone fixation (such as staple or screw)
Disadvantages
Concomitant LMPR and ACLR tibial tunnels without any convergence
Iatrogenic meniscus lesion if the LMPR suture isn't pulled out before to perform the ACLR tibial tunnel

ACLR, anterior cruciate ligament reconstruction; LMPR, lateral meniscus posterior root; LMPRT, lateral meniscus posterior root tear.

Femoral Tunnel

The femoral outside-in ACL guide (Femoral ACL Hook for Outside-In Technique; Arthrex) is placed intra-articularly at the femoral origin of the AM bundle via the anteromedial portal and on the lateral femoral cortex at the optimal ALL anisometric point. Subsequent sequential drilling up to the appropriate ACL size is then performed.

LMPR Tibial Tunnel and Reinsertion

A standard ACL tibial guide (Tibial ACL Marking Hook for Reconstruction Drill Guide; Arthrex) set at 45° is inserted through the AM portal to reach the root footprint intra-articularly and a position slightly lateral and superior to the hamstring insertion on the anterior tibial cortex. A K-wire is inserted through the guide to create a 2 mm tunnel, in which an 18-gauge spinal needle with a no 1. Ethilon loop is then inserted. A suture-passing device (Knee Scorpion; Arthrex) is used to pass a FiberWire suture (FiberWire #2, braided polybend suture; Arthrex) into the avulsed meniscal root in a cinch configuration. The no 1. Ethilon loop is then pulled out of the tibia, shuttling the FiberWire suture, which is then tensioned to confirm anatomic root reinsertion (Fig 2 A-E).

Independent ACL Tibial Tunnel

The tibial ACL guide (Tibial ACL Marking Hook for Reconstruction Drill Guide; Arthrex) is set at 55° and positioned through the anteromedial portal to achieve guidewire placement within the center of the native ACL footprint. The guide is also positioned so that the tibial guidewire enters the anterior tibial cortex medially, above the hamstring and inferiorly to the tibial tuberosity, taking care to be far enough from the previous tunnel. Then, with the assistant retracting the LMPR sutures to avoid them being cut during the drilling, the tibial tunnel is established. As for the femoral tunnel, we proceed in a sequential manner, starting with a 6 mm reamer and then upsizing to the appropriate size (equivalent to the graft diameter) once the position is confirmed.

Graft Preparation

The gracilis is incised from the base of its insertion and subsequently sutured onto the semitendinosus. The latter is then folded and tripled over itself. A no. 1 Ethibond suture is left on the distal side of the graft, to be later used for root fixation.

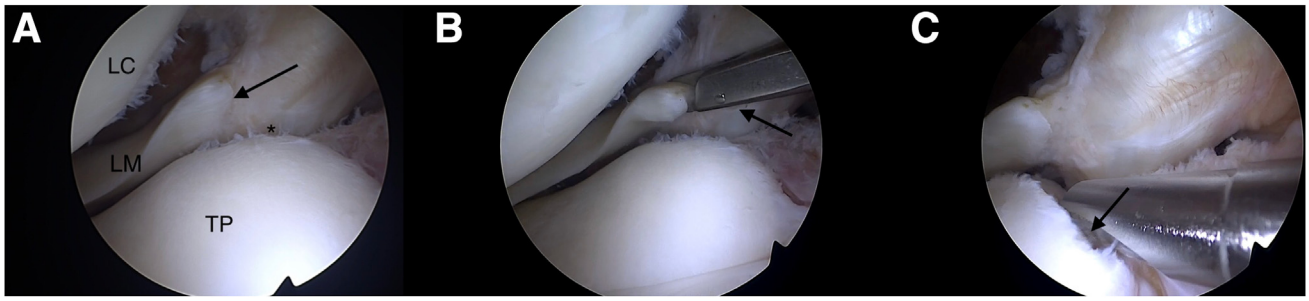

Fig 1. Right knee in 90° of flexion. (A) An arthroscopic anterolateral portal view (black arrow: LMPRT diagnosis; Black star: Root footprint). (B) LMPRT assessment (Black arrow: arthroscopic grasper). (C) LMPR footprint preparation with a shaver (Black arrow: root footprint). (LC, lateral condyle; LM, lateral meniscus; LMPRT, lateral meniscus posterior root tear; TP, tibial plateau.)

LMPR Fixation

After ACL fixation at 30° of flexion and ALL fixation in complete extension, the FiberWire used for the LMPR repair and the no. 1 Ethibond suture left on the distal side of the ACL graft are tightened together to fix the LMPR repair with the knee at 90° of flexion.[2] In this way the necessity of any further fixation is avoided (Fig 3).

Postoperative Rehabilitation

We apply a uniform postoperative rehabilitation protocol for all patients, comprising immediate weightbearing as tolerated, mobilization without the need for a brace, and a restricted range of motion from 0° to 90° for the initial 4 weeks after the surgery. Early physiotherapy focuses on achieving full extension and activating the quadriceps. The patients are allowed to gradually return to sports, starting with nonpivoting sports at 4 months, followed by pivoting noncontact sports at 6 months, and finally pivoting contact sports at 8 to 9 months.

Discussion

LMPRT is a common injury associated with ACL injury, which can lead to knee instability,[10] joint overload, and degenerative changes in the knee.[11] Many different techniques are described to manage meniscal root tears, mainly depending on their characteristics, as reported in LaPrade classification.[12] Current options for meniscal root avulsion include repair into transosseous bone tunnels, transosseous suture passage for surface fixation, and suture anchor fixation.[13-18]

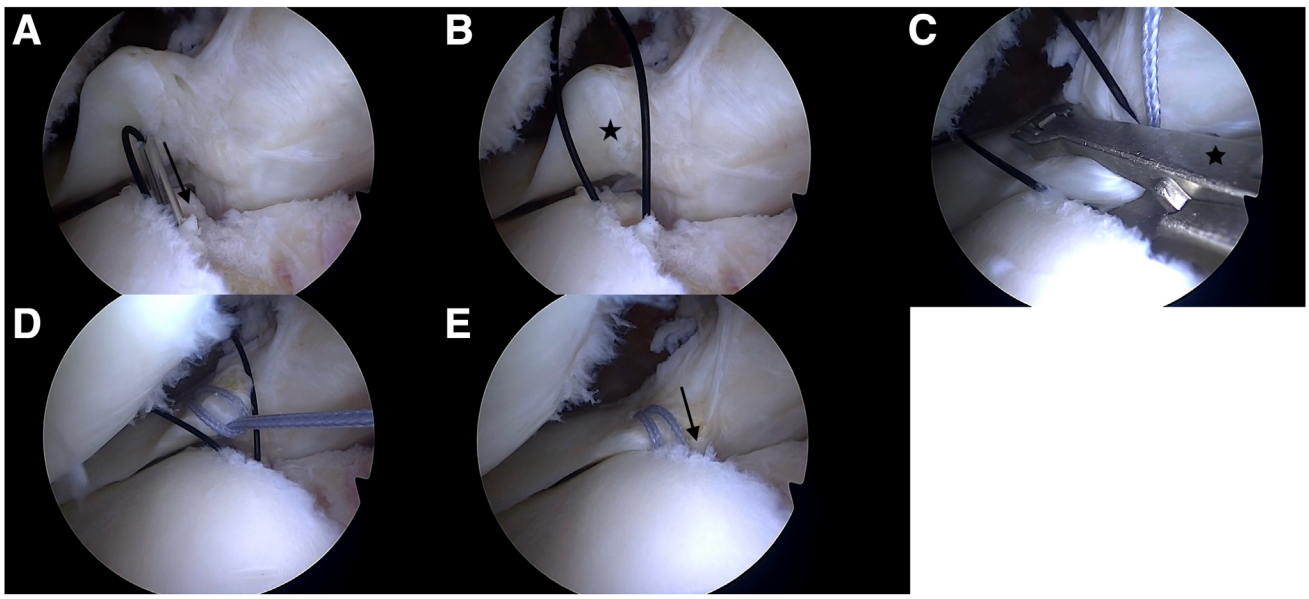

Fig 2. Right knee in 90° of flexion. Arthroscopic anterolateral portal view. (A) An 18-gauge spinal needle insertion with no. 1. Ethilon loop (Arthrex, Naples, FL). (Black arrow: needle loaded with a guide loop suture coming from the tibial tunnel) (B) Loop creation. (Black star: Root centered in the loop) (C) Suture into the avulsed LMPRT with a suture passing device (Knee Scorpion; Arthrex). (D) Pullout of the LMPR suture. (E) LMPR anatomic suture repair (black arrow: root suture entering the tibial tunnel). (LMPRT, lateral meniscus posterior root tear.)

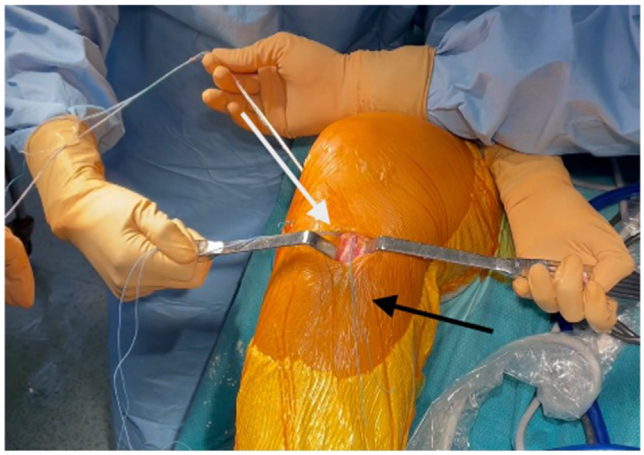

Fig 3. Right knee in 90° of flexion. LMPR suture fixation (white arrow: LMPR suture; black arrow: ACLR suture). (ACLR, anterior cruciate ligament reconstruction; LMPR, lateral meniscus posterior root.)

Transtibial repair for meniscal posterior root repairs has shown a higher frequency of healing on the lateral side compared to the medial meniscus,[19] and it is associated with improved function, reduced pain and delayed progression of knee osteoarthritis.[20] Transtibial pullout repair is also known for resulting in a greater decrease in lateral meniscal extrusion than other repair techniques in patients with ACL injury and LMPRT.[11] The novel technique described in this study offers a reproducible and safe approach for the LMPR avulsion, while avoiding potential iatrogenic meniscal damage caused by suture traction during independent ACL tibial tunnel drilling. Furthermore, compared with previously described techniques,[20,21] the current technique also has the added benefit of preserving bone stock and avoiding the need for additional tibial material fixation, because the latter is obtained by tying together the ACL reconstruction and LMPR sutures.

Disclosure

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