

How to Avoid Iatrogenic Saphenous Nerve Injury During Outside-In or Inside-Out Medial Meniscus Sutures



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Abstract: Medial meniscal sutures using outside-in or inside-out techniques are very popular. Nevertheless, a saphenous nerve entrapment may occur with these techniques. This Technical Note describes a modified outside-in medial meniscus suture without any additional skin incisions. By dissecting the space between the subcutaneous and the capsule, which is performed by grasping and knotting the sutures through the anteromedial portal, iatrogenic saphenous nerve injury is avoided.

Meniscal lesions occur frequently with anterior cruciate ligament (ACL) tears, and ~60% of ACL tears have meniscal injuries.^{1,2} Meniscal preservation is considered the optimal option through all-inside, outside-in, or inside-out techniques, depending on the tear location. The success rate after a meniscal repair with concomitant ACL reconstruction has been reported to range from 70% to 96%.^{3,4}

The literature^{5,6} has reported no significant differences in the functional outcomes of meniscal repairs between different techniques, although a superior healing rate was noted among patients treated with the inside-out technique.⁵ However, all meniscal suture techniques that require an additional skin incision showed a higher risk of injury to the saphenous nerve or its branches,

particularly for injuries involving the body of the medial meniscus. The reported frequency of saphenous nerve or its branches injuries with inside-out technique in more recent studies suggest a complication rate ranging from 1.52% to 9%.^{7,8}

This Technical Note describes the outside-in meniscal repair of the body of the medial meniscus without an additional skin incision on the medial side to knot the sutures. The rationale of this technique is based on the benefits of the cost-effective outside-in technique to prevent an iatrogenic injury to the saphenous nerve and its main branches (infrapatellar and sartorial branches).

Anatomy

The saphenous nerve runs medially to the femoral artery and continues its descent through the adductor (Hunter's) canal anterior to the femoral artery. Upon its emergence from Hunter's canal, the saphenous nerve penetrates a fascial layer between the sartorius and the gracilis muscles to emerge from the adductor canal. The nerve becomes subcutaneous ~10 cm proximal to the knee. Distal to the adductor canal, the saphenous nerve divides into infrapatellar and sartorial terminal branches⁹⁻¹¹ (Figs. 1 and 2). The infrapatellar branch of the saphenous nerve splits from the saphenous nerve in a highly variable way. It penetrates the sartorius muscle, after which it runs in a superficial course and generally forms 2 branches.¹² Both branches cross the patellar tendon in a transverse way to form the infrapatellar plexus. The infrapatellar branch of the saphenous nerve innervates the anteromedial aspect of the knee, the anterolateral aspect of the proximal part of

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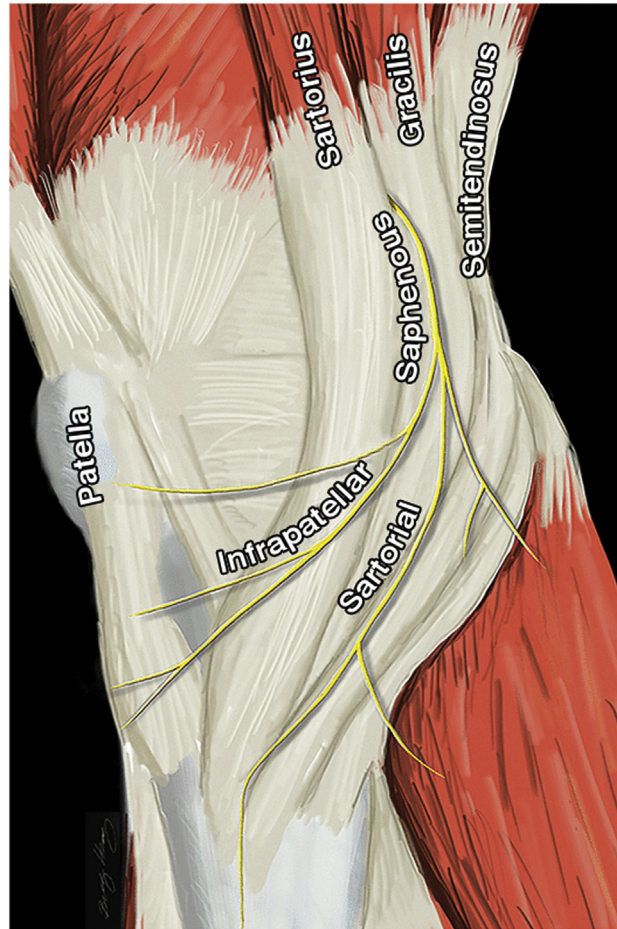


Fig 1. Anatomy of the saphenous nerve and its branches. (Reprinted with permission from Curtis et al.¹⁸)

the lower leg, and the anteroinferior part of the knee joint capsule.¹² Injury to the infrapatellar branch of the saphenous nerve usually results in numbness on the anterior aspect of the knee and the proximal lateral part of the lower leg.

The sartorial branch of the saphenous nerve courses more vertically at the posteromedial aspect of the knee behind the sartorius before becoming subcutaneous posterior to the medial femoral epicondyle by penetrating the fascia between the sartorius and gracilis tendons. The

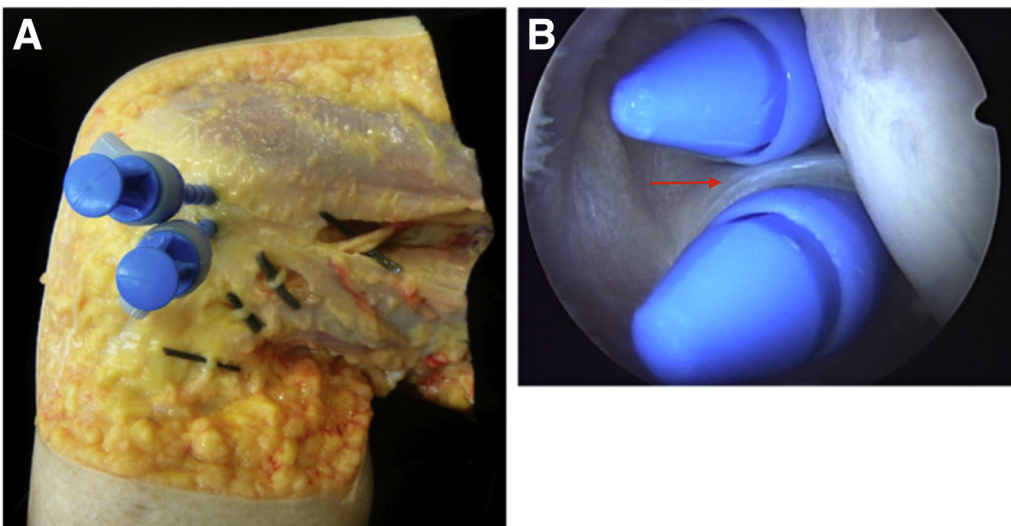


Fig 2. Cadaveric anatomy of the saphenous nerve. (A) External medial aspect of the knee. (B) Intra-articular view of the saphenous nerve. Red arrow, saphenous nerve. (Reprinted with permission from McGinnis et al.¹¹)

Fig 3. Medial aspect of right knee in 30° of flexion. An 18-gauge spinal needle is introduced by piercing the overlying capsule. Red circle, transillumination technique.

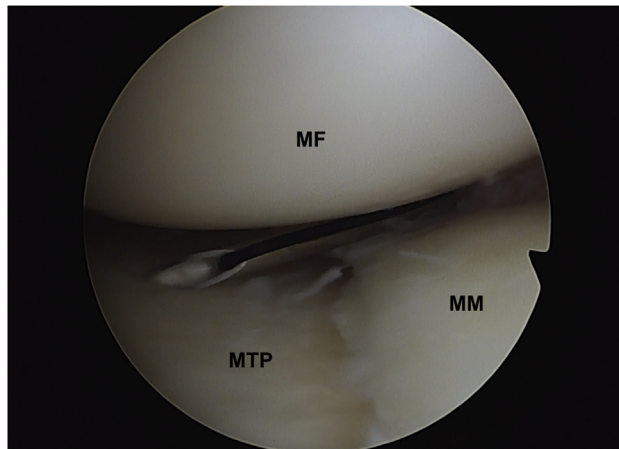
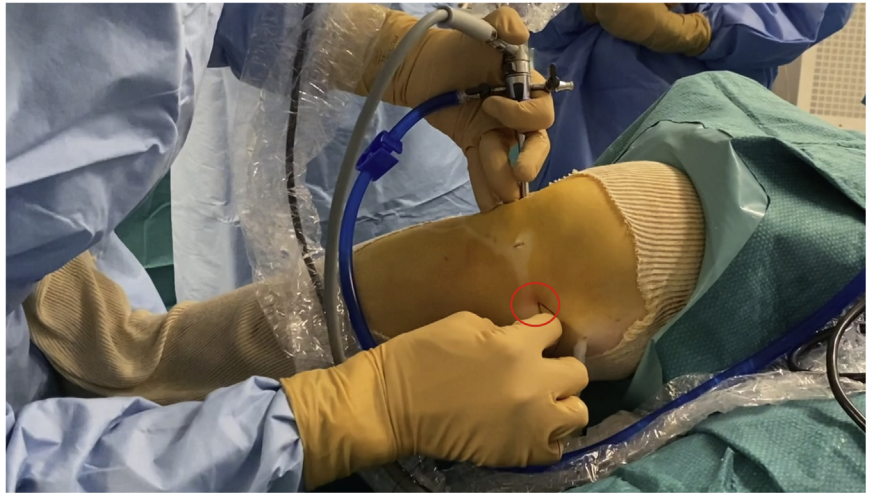


Fig 4. Arthroscopic anterior view. The needle is advanced in a vertical way above the meniscus, which traverses the area of the tear. Abbreviations: MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.

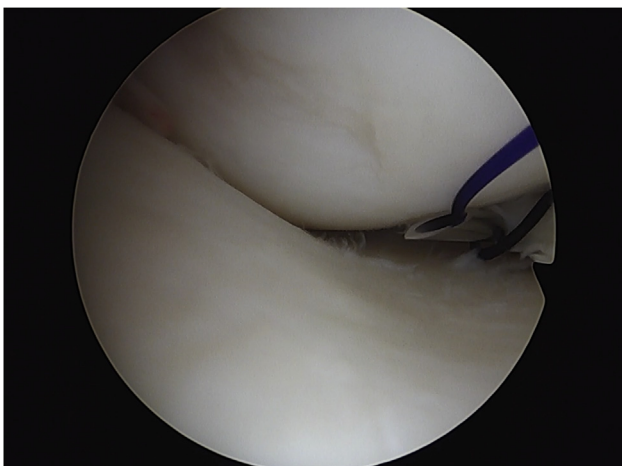


Figure 5. Arthroscopic anterior view. A no. 1 polydioxanone suture is passed through the needle into the first loop.

Table 1. Advantages and disadvantages of outside-in technique

Advantages	Disadvantages
Cost-effective	Steep learning curve
No special cannulas	No direct visualization of the knot
Reproducible	Use of a nonabsorbable suture may result in irritation by the knot
Low risk of nerve or chondral injury	
Direct visualization of the suture	

Table 2. Pearls and pitfalls of outside-in technique

Pearls	Pitfalls
No additional skin incision	Grasp the free ends of the suture in a different layer
Knot directly to the capsule	Requirement of a sliding knot

sartorial branch then continues distally with the long saphenous vein to provide sensation to the medial aspect of the leg and ankle.^{9,13} At the level of the meniscus, the sartorial branch of the saphenous nerve will rarely be encountered posterior to the muscle semitendinosus with the knee in full extension. It will also be uncommonly encountered anterior to the sartorius. This should be kept in mind during both the inside-out and the outside-in techniques of medial meniscal repair.¹³

Surgical Technique

Patient Positioning and Diagnostic Arthroscopy

The patient is placed on the operating table in the standard arthroscopy position with a lateral support using padded tourniquet and a foot roll positioned to stabilize the leg at 90° of knee flexion. High anterolateral and anteromedial portals are established. Diagnostic arthroscopy is performed, and the meniscal lesions are addressed before any ACL reconstruction.

Outside-In Surgical Technique

After confirmation of the medial meniscal lesion at the body with or without an extension up to the posterior horn, the suture is prepared after abrading the torn meniscus. An 18-gauge spinal needle is introduced by piercing the overlying capsule and is advanced in a vertical way above the meniscus, which traverses the area of the tear (Figs. 3 and 4). A no. 1 polydioxanone (PDS) looped suture (Ethicon, Raritan, NJ) is placed through the needle and into the joint. In the same way, a second needle is passed through the capsule underneath the meniscus. A no. 1 PDS suture is passed

through the needle into the first loop (Fig. 5). The free end of the previously passed PDS suture is then pulled through the looped retriever (Arthrex, Naples, FL), and the suture is pulled back out of the knee, creating a mattress suture construct to secure the body of the meniscus (Video 1). The advantages and disadvantages and the pearls and pitfalls of this technique are presented in Tables 1 and 2.

Grasping and Knotting

The free ends of the sutures are lying out of the skin at this point. An arthroscopic grasper-type Kingfisher (Arthrex) is used through the anteromedial established portal to pull the free ends out. This grasper slides directly superficial to the capsule in the deep layer of the medial knee, deeper than the saphenous nerve and its branches that are subcutaneous at this point, and the grasper is then used to pull the sutures through the anteromedial portal (Fig. 6). In this way, there is no need for an additional incision, which could be the reason for the iatrogenic injury of the infrapatellar branch of the saphenous nerve because of its horizontal course or because the sartorial branch is avoided.

Next step is the tying of the knots. A knot is prepared and is pushed with the knot pusher (Arthrex) through the anteromedial portal direct to the capsule in a knee-flexed position. Once the knot is tied, a knot cutter is used through the same portal to cut the ends (Figs. 7, 8, and 9). Any additional posterior horn lesion of the medial meniscus is sutured using all-inside device or through a posteromedial portal with a suture hook depending on the exact location of the lesion.^{14,15} Once the meniscus tear is addressed (Fig. 10), it is usually followed by ACL reconstruction.

Discussion

The outside-in repair of the body of the medial meniscus allows for the direct visualization of the needle to avoid any articular cartilage damage. Nevertheless,

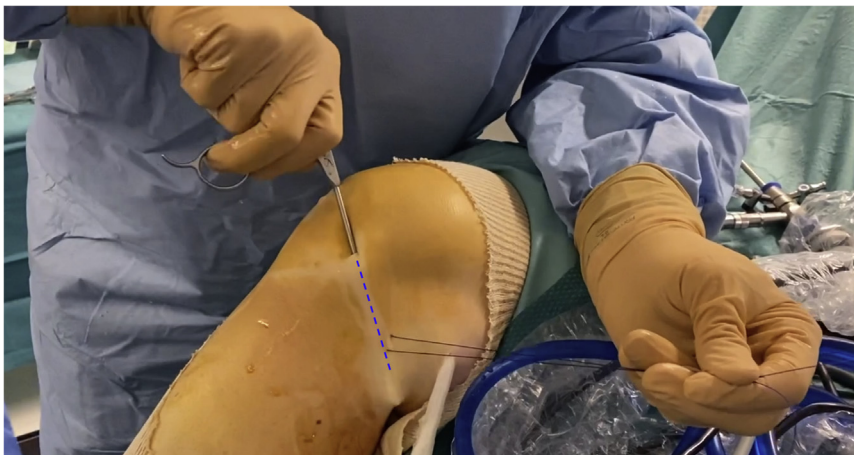


Fig 6. Medial aspect of right knee. This grasper slides directly superficial to the capsule in the deep layer of the medial knee, deeper than the saphenous nerve and its branches that are subcutaneous at this point, and the grasper is then used to pull the sutures through the anteromedial portal. Dashed blue line, dissection direction between the capsule and subcutaneous.



Fig 7. Medial aspect of right knee. Preparing the knots. Dashed blue lines, suture directions between the capsule and subcutaneous.



Fig 9. Medial aspect of right knee. The knot is tied, and a knot cutter is used through the same portal to cut the ends.

with our technique, by grasping and knotting the free ends of the suture direct to the capsule through the anteromedial portal, we avoid any iatrogenic injury of the saphenous nerve and its main branches, the infrapatellar branch and the sartorial branch, which are subcutaneous at this point. In this way, we do not have to perform any additional approaches on the medial side of the knee, in contrast to the standard outside-in repair procedure,¹⁶ in which a medial approach has to be performed to correctly grasp and knot the free ends.

Many suture techniques for the medial meniscus have been described. The existing literature indicates that all-inside, inside-out, and outside-in repair techniques can produce favorable results in patients with repairable meniscus tears.^{5,6} However, there is a need

for additional prospective studies or retrospective group-matched studies to evaluate the long-term outcomes of these suture techniques.

The all-inside technique has good clinical outcomes, but there is concern over the availability of the appropriate instruments.¹⁷ The alternative technique is the inside-out suture, which needs special cannulas to insert the needles.¹⁷ The outside-in technique remains the simplest and most cost-effective suture technique and requires no special equipment. The surgeon can truly evaluate the direction of the suture with direct arthroscopic observation. Furthermore, with our modified outside-in technique, there is no need for an additional skin incision on the medial knee to grasp and tie the free ends of the suture (Table 1). The whole procedure is

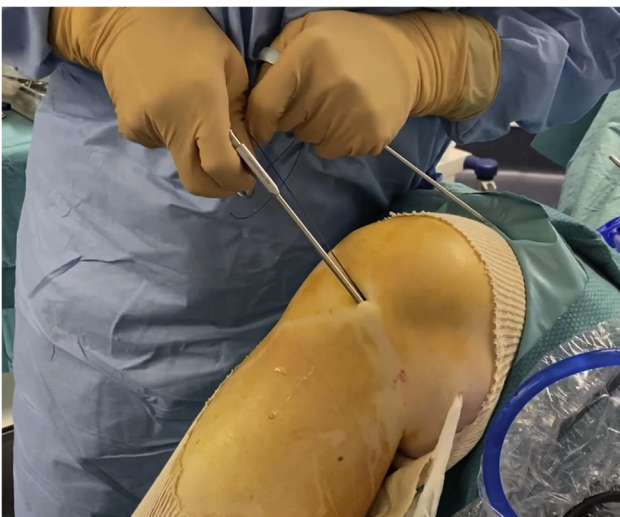


Fig 8. Medial aspect of right knee. The knot is pushed with the knot pusher through the anteromedial portal direct to the capsule in a knee-flexed position.

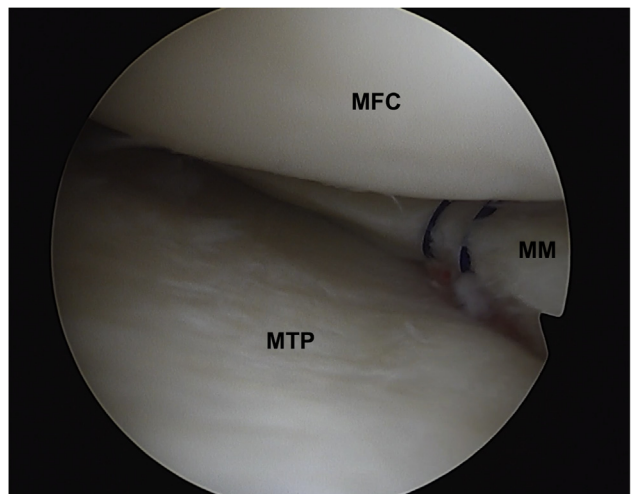


Fig 10. Arthroscopic anterior view. Final aspect of the body of the medial meniscus. Abbreviations: MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.

performed through the anteromedial portal by passing the arthroscopic grasper and later the knot pusher in a direct subcutaneous way all along the capsule. Therefore, the risk of iatrogenic injury of the saphenous nerve and its main branches is minimized.

We describe our modified outside-in technique which uses grasping and knotting of the free ends of the suture from the anteromedial portal. It is evident that the same procedure could be followed using the inside-out suture technique.

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