

All-Inside Suture Repair for Isolated Radial Tears at the Midbody of the Lateral Meniscus



Ryohei Uchida, M.D., Ph.D., Shuji Horibe, M.D., Ph.D., Yoshiki Shiozaki, M.D., Ph.D., and Konsei Shino, M.D., Ph.D.

Abstract: In young athletes, radial tear of the midbody on the semilunar lateral meniscus in stable knees is most common. Conventionally, for this type of tear, meniscectomy has been considered as a first-line treatment. However, meniscectomy does not prevent degenerative change. Therefore, repair is another treatment option for a full radial tear, though this type of tear can be difficult to repair because of the lack of a vascular supply. Compared with conventional transcapsular suture techniques (e.g., inside-out/outside-in techniques or all-inside techniques with implants), all-inside suture (AIS) repair techniques can avoid bunching of the meniscus to the capsule. AIS is considered suitable for restoration of normal structure and movement of the meniscus after repair, which can be advantageous for meniscal healing. However, AIS repair for an isolated radial tear at the midbody of the lateral meniscus has rarely been reported. Therefore, we applied the AIS repair technique for isolated radial tear at the midbody of the semilunar lateral meniscus using a QuickPass SutureLasso with 2-0 FiberWire. This procedure is easier and less invasive, shortening the gap by drawing each stump of the meniscus in the direction of the circumference.

In young athletes, radial tear is most common in the semilunar lateral meniscus in stable knees, and all of these radial tears occur at the midbody.¹ This type of tear disrupts the circumferential fibers of the meniscus, resulting in the loss of main resistance to hoop stresses.^{2,3} Conventionally, meniscectomy is the first line of treatment for this type of tear, but it does not prevent degenerative changes. Therefore meniscal repair is performed as an alternative treatment for radial tears involving the vascular zone. Repair of isolated radial tears at the midbody of the lateral meniscus has been rarely reported.⁴⁻⁷ Whereas some have described the use of conventional transcapsular

suture repair for radial tears at the midbody of the lateral meniscus, including inside-out and outside-in repair,⁴⁻⁶ second-look evaluations revealed poor results,⁴ despite relatively satisfactory results on clinical evaluation.

Recently, new devices for all-inside suture (AIS) repair techniques that require no transcapsular suture have

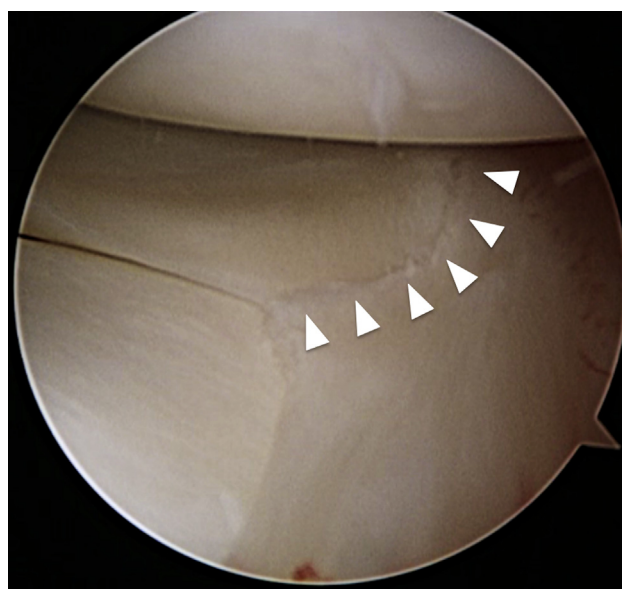


Fig 1. Arthroscopic view of oblique tear at midbody of lateral meniscus in left knee. White arrowheads shows radial tear.

From the Department of Orthopaedic Sports Medicine (R.U., Y.S.), Seifu Hospital, Osaka; Sports Orthopaedic Center (R.U., K.S.), Yukioka Hospital, Osaka; and the Faculty of Comprehensive Rehabilitation, Osaka Prefecture University (S.H.), Osaka, Japan.

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Address correspondence to Ryohei Uchida, M.D., Ph.D., Sports Orthopaedic Center, Yukioka Hospital, 2-2-3 Ukita, Kita-ku, Osaka, Osaka 530-0021, Japan. E-mail: uchida3847@gmail.com

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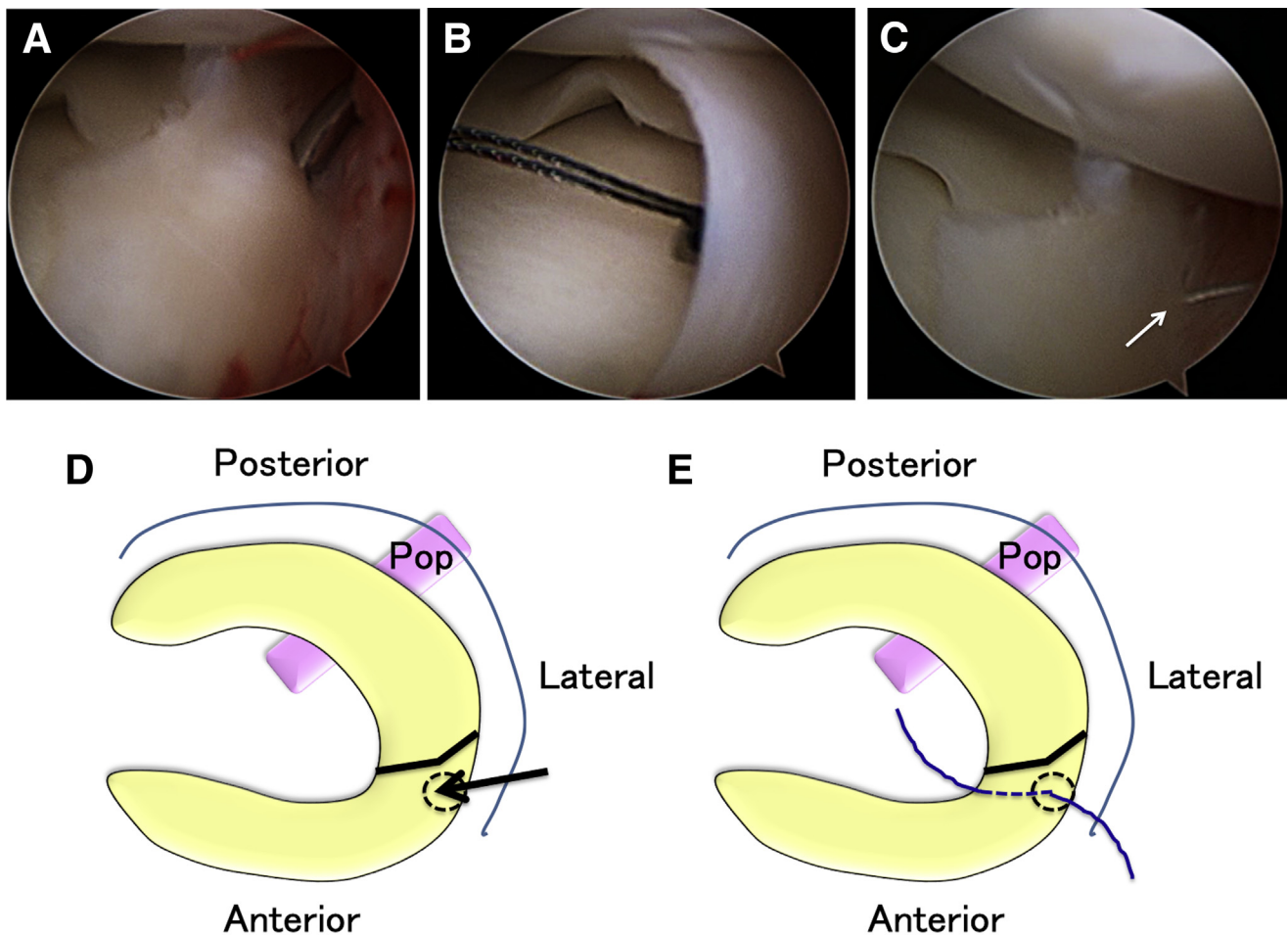


Fig 2. Arthroscopic views and schemata of the surgical technique for suture penetration of the anterior stump in the left knee. First, the needle tip of the QuickPass SutureLasso 45° curve left is penetrated to the anterior stump of the lateral meniscus vertically in the left knee (A and D). Then, the wire loop is fed from the lumen of the device after turning up needle tip between the lower surface of the anterior stump and the joint surface of the lateral tibial plateau, with attention to prevent for damage the cartilage (B). Finally, 2-0 FiberWire is passed through the anterior stump of the lateral meniscus (white arrow) after extra-articular suture relay (C and E). POP, Popliteus tendon.

been developed. Compared with conventional trans-capsular suture techniques (e.g., inside-out/outside-in techniques, all-inside techniques with implants), AIS techniques can avoid bunching of the meniscus to the capsule. Therefore AIS techniques are considered suitable for normalization of the morphology and movement of the meniscus after repair, which can be advantageous for meniscal healing.^{7,8} Only one report has described AIS repair for radial tears at the midbody of the lateral meniscus,⁷ showing that sufficient short-term results could be obtained, although most patients had incomplete discoid menisci. The purpose of this Technical Note is to describe an AIS repair technique for isolated radial tears in the midbody of the lateral meniscus extending to the vascular zone.

Surgical Technique

This technique is used to repair isolated radial/oblique tears in the red-white or red-red zone of the lateral

meniscus at midbody ([Fig 1](#), [Video 1](#)). It requires special equipment, such as the QuickPass SutureLasso 45° Curve Left/Right (hereafter, SutureLasso) with 2-0 FiberWire sutures and a plastic or passport cannula (Arthrex, Naples, FL).

With the patient in the supine position, the operative extremity is prepared and draped in the usual fashion for routine knee arthroscopy. Arthroscopic evaluation is performed using 2 standard anterior knee arthroscopy portals. After the cruciate ligaments and chondral status are evaluated, meniscal repair is performed with an additional far anteromedial portal in the figure-four leg lock position.

First, the lateral meniscus is carefully probed to check the state of the damaged meniscus and the region of the tear. The sites of tears in the meniscus and adjacent synovium are refreshed with a rasp to promote healing with an adequate vascular supply. The initial 2 penetration points for both the anterior and posterior stumps

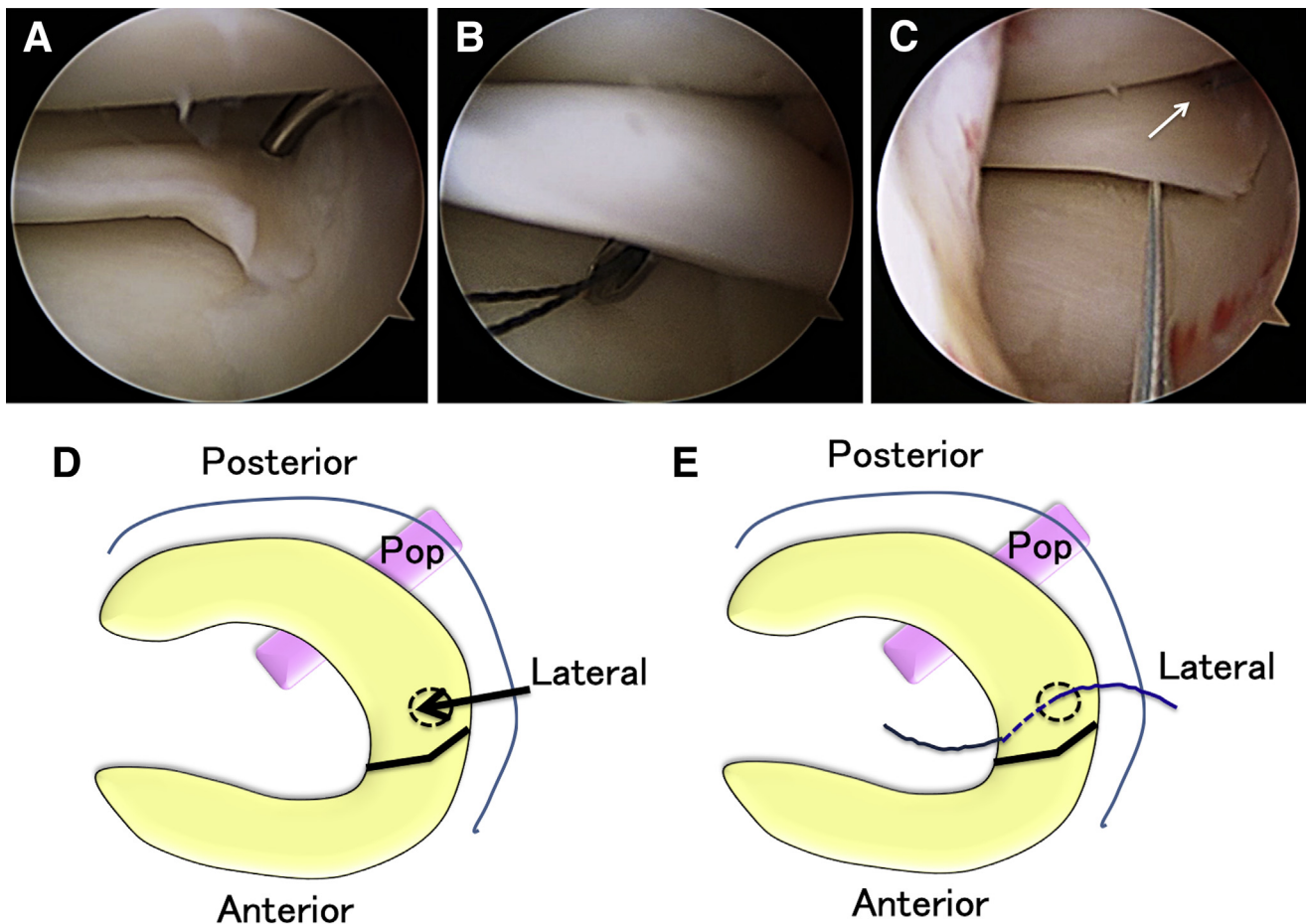


Fig 3. Arthroscopic views and schemata of the surgical technique for suture penetration of the posterior stump in the left knee. First, the needle tip of the QuickPass SutureLasso 45° Curve Left is penetrated to the posterior stump of the lateral meniscus vertically in the left knee (A and D). Then, the wire loop is fed from the lumen of the device after turning up the needle tip between the lower surface of the posterior stump and the joint surface of the lateral tibial plateau, with attention to prevent damage to the cartilage (B). Finally, a 2-0 FiberWire is passed through the posterior stump of the lateral meniscus (white arrow) after extra-articular suture relay (C and E). POP, Popliteus tendon.

of the torn meniscus are carefully decided, because the location of these points is important for avoiding suture cut-out in the meniscal body and aligning the anterior and posterior stumps.

The SutureLasso is inserted into the joint through the anterolateral portal, vertically penetrating the anterior stump of the meniscus from the upper surface to the lower surface without damage to the tibial plateau articular cartilage (Fig 2 A and D). After this, the wire loop is fed from the lumen of the device and then taken out of the joint through the anteromedial or far anteromedial portal using a suture retriever. The leading limb of the 2-0 FiberWire is then passed through the wire loop after removal of the SutureLasso from the joint (Fig 2B). The opposite limb of the wire loop is pulled, allowing the leading limb of the FiberWire to penetrate the anterior stump from the lower to the upper surface (Fig 2 C and E). Then, the SutureLasso is inserted again into the joint through the anterolateral portal, penetrating the posterior stump from the upper

surface (Fig 3 A and D). The wire loop is fed from the device into the joint and then taken out of the joint again (Fig 3B). The opposite limb of the FiberWire is used to penetrate the posterior stump in the same manner as in the case of the anterior stump (Fig 3 C and E). A sliding or nonsliding knot is tied using standard arthroscopic methods to place a horizontal suture through a plastic or passport cannula (Arthrex, Naples, FL) (Fig 4). The number of sutures is decided according to the length of the tear.

Surgeons using our technique should note the following: First, there are 2 types of SutureLasso (ie, left and right), so it is important to use them properly. When the right knee is affected, the SutureLasso Right is usually used; however, in rare cases, it is easier to use the SutureLasso Left for penetration. Second, as an additional procedure to promote healing, a fibrin clot is set into the tear site of the lateral meniscus, and microfracture of the lateral wall of the lateral femoral condyle is performed with care so as not to damage the

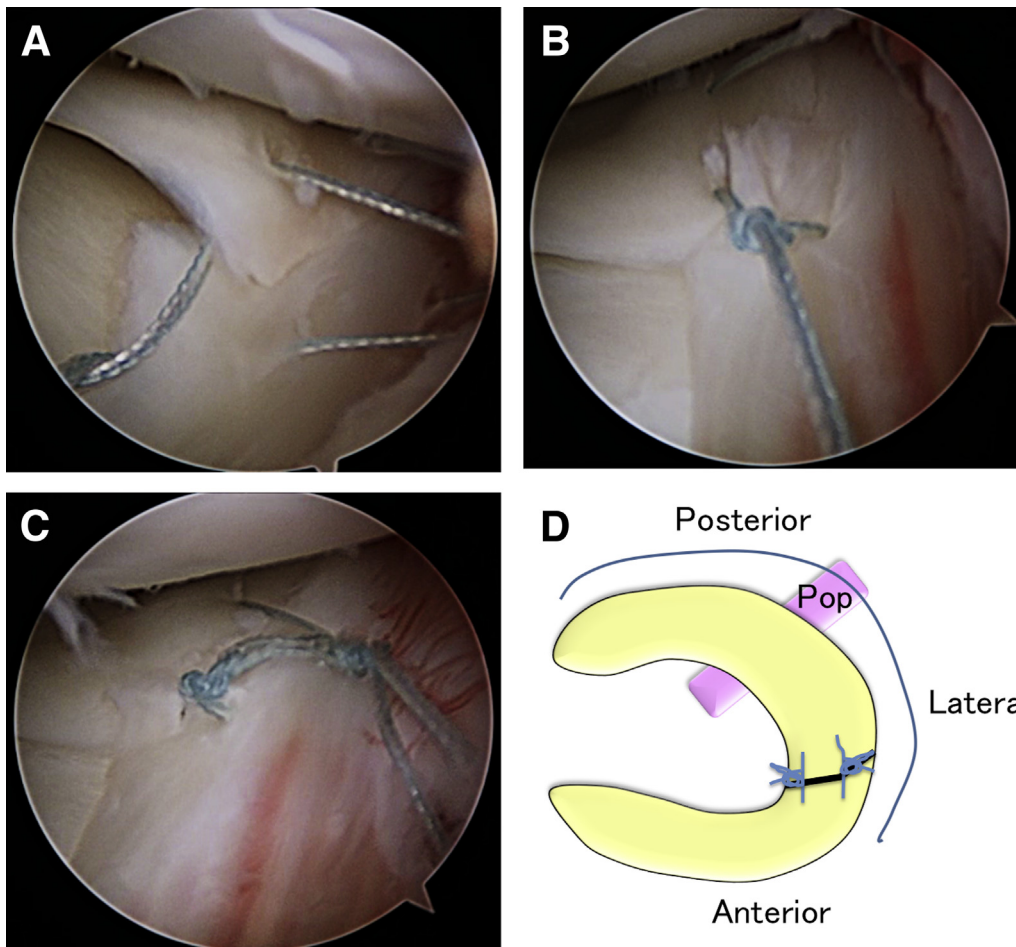


Fig 4. Arthroscopic views and schema of knot tying in the left knee. Two sutures are passed through both anterior and posterior stumps (A). The inner suture is tied (B), and then the outer suture is tied (C). For this oblique tear, 2 sutures are tied on the upper surface of the meniscus. POP, Popliteus tendon.

soft tissues or intra-articular cartilage. During the arthroscopic evaluation, 20 to 30 mL of the peripheral blood was aspirated from the ipsilateral ankle or foot to prepare the fibrin clot. Then, the blood was stirred gently with a sintered glass stick in a sterile glass beaker, until a fibrin clot precipitated on the surface of the stick after 10 to 15 minutes. After excessive water or blood was wiped from the fibrin clot, 1 or 2 nonabsorbable sutures (eg, 2-0 Ethibond) were passed through the fibrin clot 3 or 4 times with needles. Before placing the fibrin clot, 1 or 2 nonabsorbable sutures were passed from the periphery of the meniscus into the tear site using a SutureLasso. The prepared clot was introduced into the joint with suture relay. With an arthroscopic probe, the clot was placed in the tear site.

After surgery, the knee was immobilized with a knee brace for 2 weeks. Partial and full weightbearing were permitted at 6 and 8 weeks after repair, respectively. Sports activity was allowed at 6 months after second-look arthroscopy.

By comparing preoperative and early postoperative magnetic resonance imaging (MRI), the gap between stumps was shortened and appeared to disappear like a noninjured semilunar meniscus (Fig 5). This suggests

that AIS repair could restore the meniscus morphology after repair.

Discussion

Radial tears of the midbody of the lateral meniscus in young patients can be difficult to repair and often lack the vascular supply necessary for healing.⁹ They are also problematic due to possible degenerative changes in the future. Meniscal repair for radial tears has been reported rarely.⁴⁻⁷ Conventional transcapsular suture repair techniques for radial tears at the midbody of the lateral meniscus, including inside-out and outside-in techniques, have been reported to yield relatively satisfactory results on clinical evaluation.⁴⁻⁶ However, the sample size was small in most of these reports, and, in one study,⁴ second-look evaluations after inside-out repair of radial tears at the midbody of the lateral meniscus revealed that only 22% of patients achieved complete healing.

Recently, new devices have been developed for use in AIS repair. These devices, including Knee Scorpion (Arthrex, Naples, FL), NovoStitch suture passer (Ceterix, Menlo Park, CA), and Meniscal Viper (Arthrex, Naples, FL), can avoid complications caused by implants used in

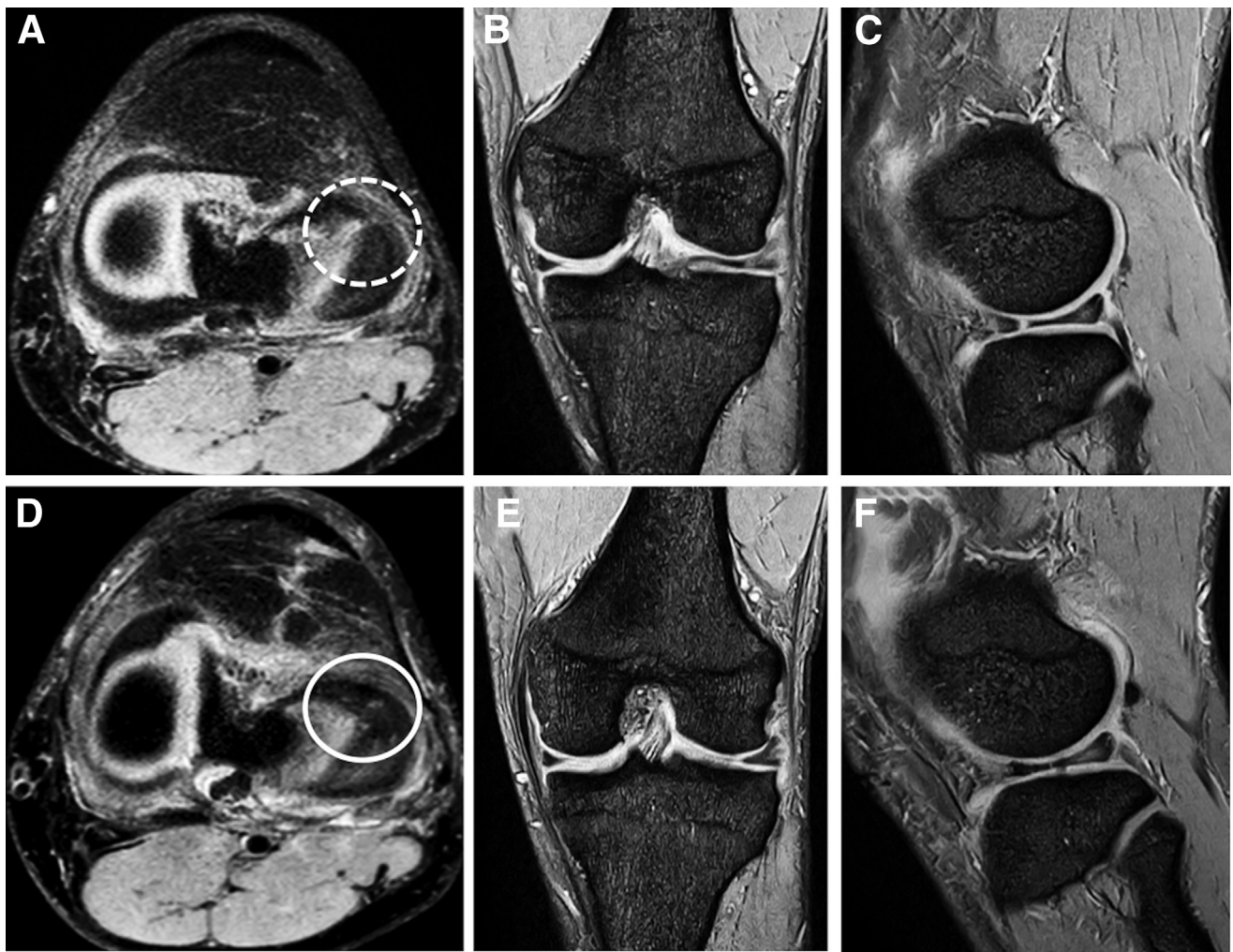


Fig 5. Preoperative and postoperative findings of an oblique tear at the midbody of the lateral meniscus in the left knee on magnetic resonance imaging (MRI). On preoperative MRI, an oblique tear was found at the midbody of the lateral meniscus as a high signal gap (white dotted circle) on each axial (A), sagittal (B), or coronal (C) image. However, on the 1-week postoperative MRI, there was almost no high signal (white circle) at the tear site on each axial (D), sagittal (E), or coronal (F) image.

conventional all-inside repair and prevent bunching of the meniscus to the capsule, unlike conventional trans-capsular suture techniques. It is believed that AIS techniques could normalize the morphology and movement of the meniscus,^{7,8} which is advantageous for meniscal

healing. Moreover, AIS is a less-invasive technique because additional skin incision is not necessary. Among AIS repair techniques, our technique uses the SutureLasso, which is easier to use when repairing radial tears of the midbody of the lateral meniscus, compared with the above-mentioned devices (i.e., Knee scorpion, NovoStitch, and Meniscal Viper), used mainly for the posterior part of the torn meniscus due to their bulky size. However, our technique has some disadvantages. In AIS repair, articular cartilage damages may occur during the penetration of stumps by SutureLasso. The advantages and disadvantages and pearls and pitfalls of our technique are summarized in [Tables 1](#) and [2](#), respectively.

There are few clinical reports on all-inside repair of radial tears at the midbody of the lateral meniscus. Choi et al.⁷ reported an AIS repair for radial tears at the midbody of the lateral meniscus using a suture hook, which yielded sufficient short-term results in all patients. However, only one patient had a torn semilunar

Table 1. Advantages and Disadvantages of Procedure

Advantages	
Only standard anterior portals without the posterolateral incision	
Easy approximation of the gap by drawing each stump in the direction of the circumference without traction of stumps toward the periphery	
Easily approach to the anterior and posterior stumps by SutureLasso	
Less posterior neurovascular injury	
Disadvantages	
Larger penetration hole using SutureLasso than the needle hole in inside-out repair	
Possible articular cartilage damage during the penetration of stumps by SutureLasso	

Table 2. Pearls and Pitfalls of Procedure**Pearls**

- Careful decision of penetration points on both the anterior and posterior stumps
- Vertical penetration to the stumps by SutureLasso
- The use of a plastic or passport cannula to avoid tangling the suture during the knot tying

Pitfalls

- Overlap or dislocation of anterior and posterior stumps
- Laceration of the stumps during penetration by SutureLasso
- Cutting the stumps by suture during knot tying

lateral meniscus, and the remaining 13 patients had incomplete discoid lateral menisci. Thus clinical data are lacking with regard to all-inside suture repair for radial tears at the midbody of the semilunar lateral meniscus. Technically, in repairing a torn radial semilunar meniscus, the AIS repair using SutureLasso is easier and less invasive, shortening the gap by drawing each stump of the meniscus in the direction of the circumference.

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