

Arthroscopic Ramp Repair: “No-Implant, Pass, Park, and Tie Technique” Using Knee Scorpion



Sheetal Gupta, M.S., M.B.B.S., Prayank Hishikar, M.B.B.S., M.S., and Binayak Ray, M.B.B.S., M.S.

Abstract: Ramp lesions play a significant role in both anteroposterior and rotational knee stability. Ramp lesions are difficult to diagnose clinically as well as on magnetic resonance imaging. Arthroscopic identification by visualizing the posterior compartment and probing via the posteromedial portal will confirm the diagnosis of ramp lesion. Failure to address this lesion properly will lead to poor knee kinematics, residual knee laxity, and increased chances of failure of reconstructed anterior cruciate ligament. Here, we describe a simple arthroscopic surgical technique to repair ramp lesion, the pass, park, and tie at the end, via 2 posteromedial portals using a knee scorpion suture passing device.

Ramp lesions, first described by Strobel, are meniscocapsular or meniscosynovial longitudinal peripheral tears of the posterior horn of the medial meniscus. Ramp lesions are considered as hidden lesions because they are missed not only on preoperative magnetic resonance imaging but also on arthroscopic examination if done through standard portals.^{1,2} Ramp lesion, if left untreated, will lead to rotational instability, retear of the reconstructed anterior cruciate ligament (ACL), and altered biomechanics of the knee joint.^{3,4} Thaunat et al.⁵ classified ramp lesions and described a technique for their repair using a single posteromedial (PM) portal. We describe here a simple technique of “pass, park, and tie,” which uses an antegrade suture device with 3 major portals: a high PM portal for visualization, a low PM portal for instrumentation, and an anterolateral (AL) portal for parking the sutures.

Surgical Technique (With Video Illustration)

Positioning

Under spinal anesthesia, the patient is positioned supine on the operating table with the knee in 90° of flexion at the edge of the table on the affected side to allow full range of motion and adequate exposure to back of the knee (Fig 1a). In this position, the neurovascular bundle falls posteriorly. A thigh support is placed just proximal to the knee at mid-thigh level. The tourniquet is placed high on the thigh.

The operative site is prepared with an aseptic sterile technique. Draping is done in the standard way to expose the distal one-third of the thigh and proximal one-third of the leg. The lower limb is exsanguinated, and the tourniquet is inflated. Provisional surface marking is done (Fig 1b). Required instrumentation for surgery is prepared on back table (Fig 2).

Portal Placement and Arthroscopy

A standard AL portal is created 1 cm above the joint line and just next to the patellar tendon in a palpable soft spot. A second anteromedial portal is made 1 cm above the joint line and 1 cm medial to the patellar tendon in a palpable soft spot. Diagnostic arthroscopy is performed first (Video 1). We look for an ACL tear, any associated meniscal tear, and the meniscal mobility.

For identification of ramp lesion from the anterior compartment, a 30° arthroscope (AL portal) is passed through the medial wall of intercondylar notch beneath the posterior cruciate ligament and with the knee slightly flexed in valgus (Gillquist maneuver) to enter the PM compartment.

From Galaxy Hospital, Bhopal, Madhya Pradesh, India.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received November 6, 2022; accepted February 8, 2023.

Address correspondence to Dr. Sheetal Gupta, M.S., M.B.B.S., Galaxy Hospital, 25 Danish kunj, Kolar road, Bhopal, Madhya Pradesh, 462042, India. E-mail: drsheelalkumar@gmail.com

© 2023 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/221465

<https://doi.org/10.1016/j.eats.2023.02.005>

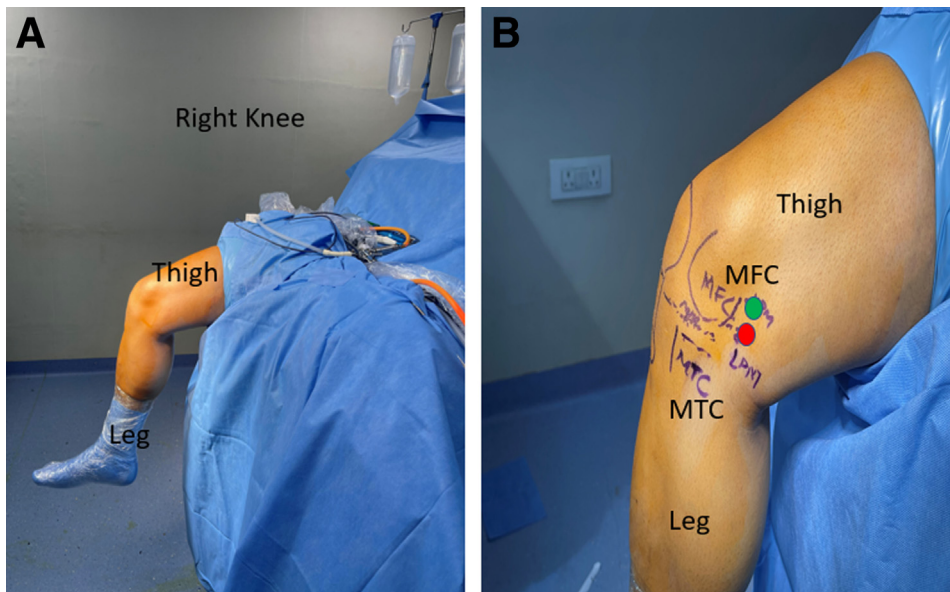


Fig 1. (A) Right knee, positioning of the limb: the patient is in a supine position with a tourniquet over the thigh. The right leg is hanging down at the edge of table in 90° flexion with lateral side support. (B) Surface marling of right knee showing marking for MFC, medial femoral condyle, MTC, medial tibial condyle, red dot for low posteromedial portal, and green dot for high posteromedial portal.

From the PM aspect of knee just above the joint line, an 18-G spinal needle is passed (outside in) from low PM portal with the help of transillumination (Fig 3 a and b). A tear at the meniscocapsular junction, using a needle as a probe, confirms the ramp lesion (Fig 4).

Once the diagnosis of ramp lesion is confirmed, 2 PM portals are made. A low PM portal is made just above the joint line with the transillumination technique to avoid neurovascular structures. An 18-G spinal needle

is passed, followed by portal creation over spinal needle trajectory with a no. 11 blade scalpel and a hemostat under direct vision. An 8-mm arthroscopic cannula or PassPort Cannula (Arthrex, Naples, FL) is then placed for ease of instrumentation through this portal (Fig 5a). The edges of the tear are abraded with the help of a shaver or meniscal rasp to stimulate the healing response. A high PM portal is made in the same manner 4 cm above the joint line.

Fig 2. Instruments used for this technique: from left—switching stick, spinal needle, suture manipulator, 6-mm cannula, knot pusher, 8-mm cannula, suture cutter, PassPort Cannula 6-mm, Scorpion needle, 8-mm PassPort cannula, Knee Scorpion, arthroscopic sleeve with trocar.

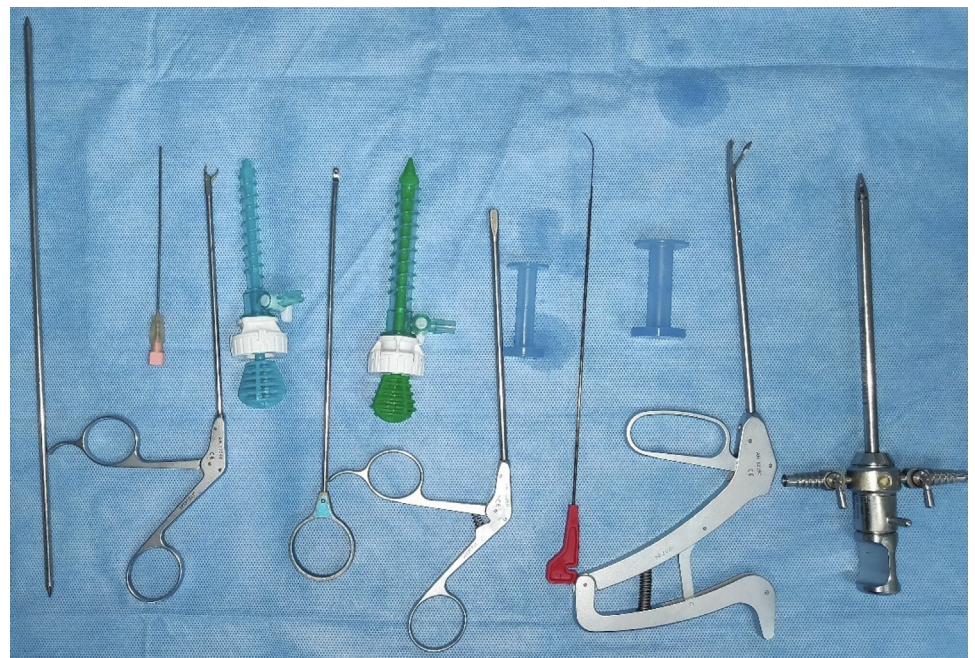
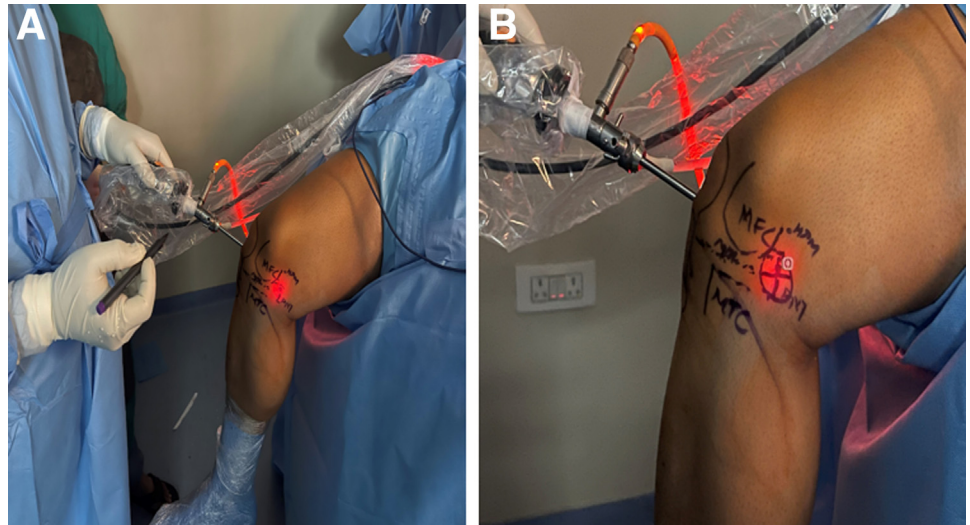


Fig 3. Right knee in 90° flexion: Portal placement using transillumination technique. (A) Spinal needle is introduced using transillumination in the posteromedial compartment. (B) Posteromedial portal is created using a no. 11 blade.



Posterior Compartment Arthroscopy and Ramp Repair

A switching rod is then passed, and the arthroscope is switched to high PM portal and probing is done (Fig 5b). We use an all-inside antegrade suture technique for repair of the ramp lesion with passing and parking of sequential sutures and tying at the end.

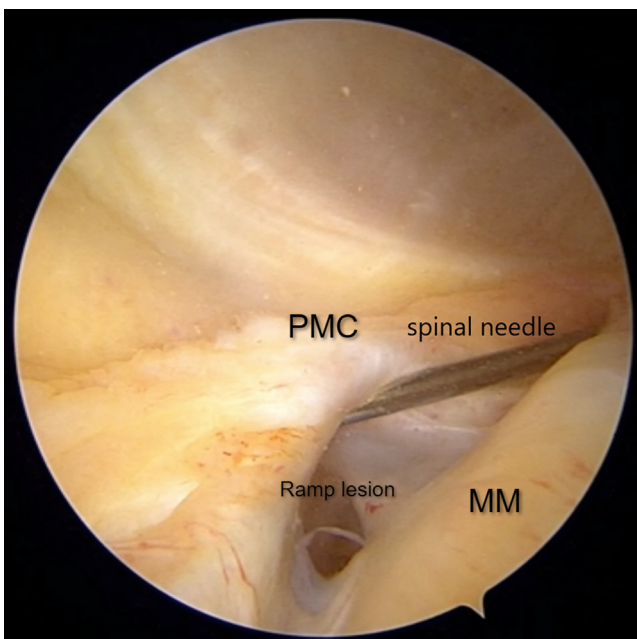


Fig 4. Right knee in 90° flexion: Visualization is from the anterolateral portal, using Gillquist maneuver, entry is made into the posteromedial compartment, needle test is performed using a spinal needle to confirm the ramp lesion. Same spinal needle is used as trajectory to make create the posteromedial portal. (MM, medial meniscus; PMC, posteromedial capsule.)

As the ramp is a longitudinal tear, there are 2 portion/leaves—the anterior (meniscal side) and the posterior (capsular side). The ramp repair technique is basically approximating these 2 surfaces. A Knee Scorpion (Arthrex) is introduced, loaded with one end of no. 2-0 FiberWire suture (Arthrex), through the low PM portal via a cannula. Using the Scorpion, a first bite is taken on anterior aspect of the tear (meniscal side) (Fig 6a). The Knee Scorpion is manipulated such that it holds the substance of meniscus well and its tip penetrates the medial meniscus from inferior to superior. In case of difficulty in passage knee a flexion—extension maneuver can be performed to ensure a good bite. This device, the self-retrieving suture device 2-0 FiberWire, is passed through the meniscus and retrieved via the PM portal. The 2-0 FiberWire is removed from the Scorpion. Another end of 2-0 FiberWire is now mounted onto the Scorpion again.

The Scorpion is introduced through low PM cannula, and this time a bite is taken on the posterior aspect (capsular side) of the tear (Fig 6b). Ensure a good tissue bite from the capsular side also; this step passes the suture through the capsular side and is retrieved out through the low PM cannula. Now, both the sutures are ready and already passed though both meniscus side and capsular side (Fig 6c). Confirm that there is no entanglement of sutures. Now, the suture retriever is passed from AL portal and both suture ends are taken out through this portal for parking suture here for knot tying at later stage (Fig 6d). Knot-tying is not done at this stage; otherwise, it will be very difficult to pass the Scorpion device underneath the meniscus and capsule. Now, another FiberWire is taken loaded onto the Knee Scorpion, and a bite is taken in similar manner as described previously (Fig 7 a-c). Again, 2 suture ends are retrieved from AL portal for parking and knot-tying

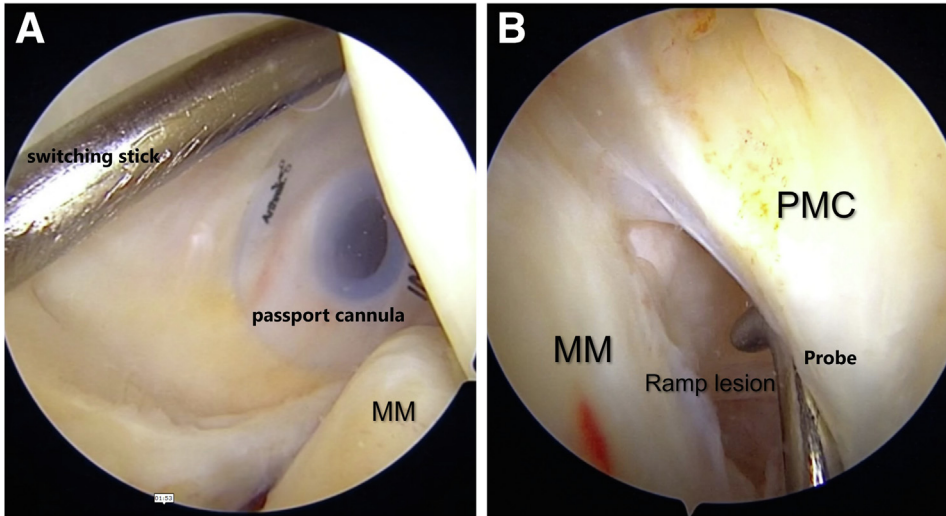


Fig 5. (A) Right knee in 90° flexion: Looking from the anterolateral portal into the posteromedial compartment, a low posteromedial portal is created, and PassPort Cannula is introduced for instrumentation, a high posteromedial portal is created and switching stick is introduced. (B) Now the arthroscope is shifted to the high posteromedial portal using the switching stick and probing of the ramp lesion is done through the low posteromedial portal. (MM, medial meniscus; PMC, posteromedial capsule.)

at a later stage (Fig 7d). Depending on size of the tear, more sutures can be “passed and parked” (Fig 8 a-c). In the technique demonstrated here, one more bite is

taken from the meniscus and capsule. Now, we are ready for knot-tying; we prefer to use nonsliding multiple half hitches so a cheese-grating effect on the

Fig 6. Right knee in 90° flexion: visualization through the high posteromedial portal and instrumentation from the low posteromedial portal. (A) The first bite is taken from the meniscus using an antegrade suture passing device—Knee Scorpion loaded with FiberWire sutures. (B) The second bite is taken from the posterior capsule. (C) The first set of sutures can be seen with some approximation of the ramp lesion. (D) The first set of sutures is parked through the anterolateral portal without tying the knot to ease the further suture passing. (fw, FiberWire; MM, medial meniscus; PMC, posteromedial capsule.)

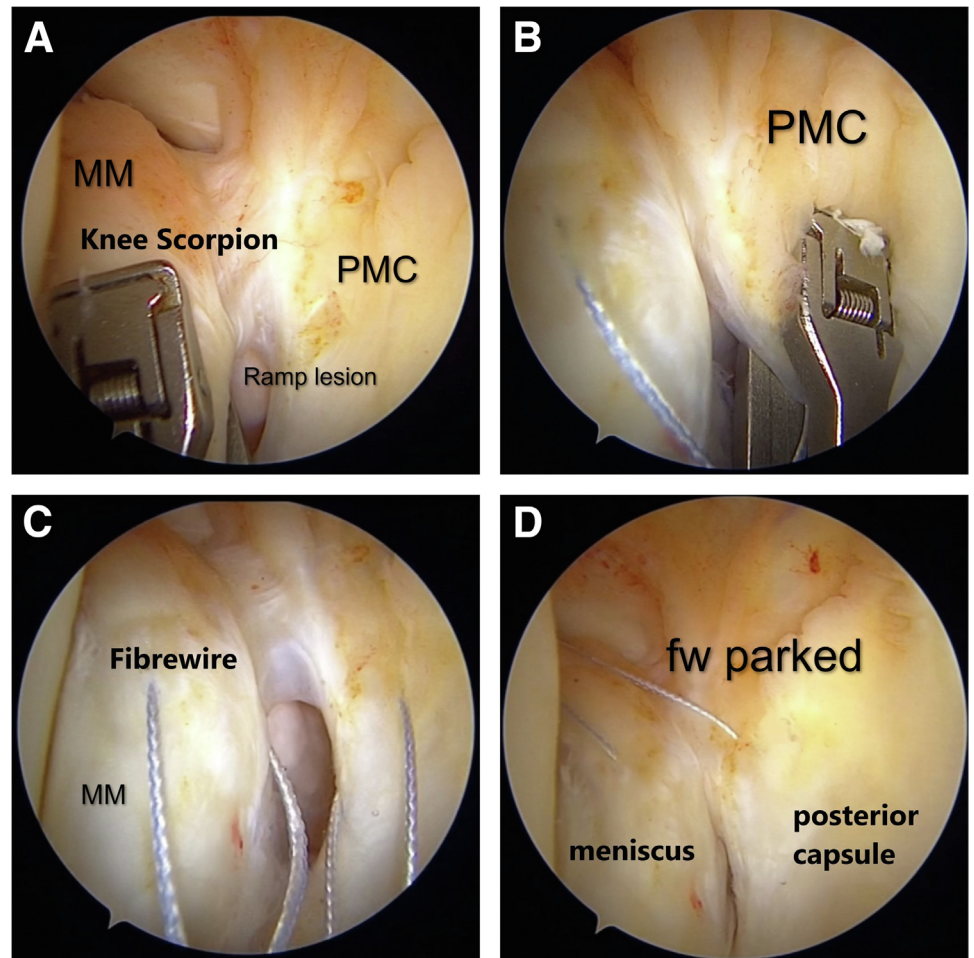


Fig 7. Right knee in 90° flexion: visualizing from the high posteromedial portal and instrumentation from the low posteromedial portal. (A) The third bite is taken again from the meniscus using the Knee Scorpion loaded with FiberWire. (B) The fourth bite through the posterior capsule; the Scorpion needle is turned away from the articular cartilage to avoid damage. (C) The second set of sutures with further approximation can be seen. (D) The second set of sutures also is parked through the anterolateral portal for the later knot-tying process. (fw, FiberWire; MFC, medial femoral condyle; MM, medial meniscus; PMC, posteromedial capsule.)

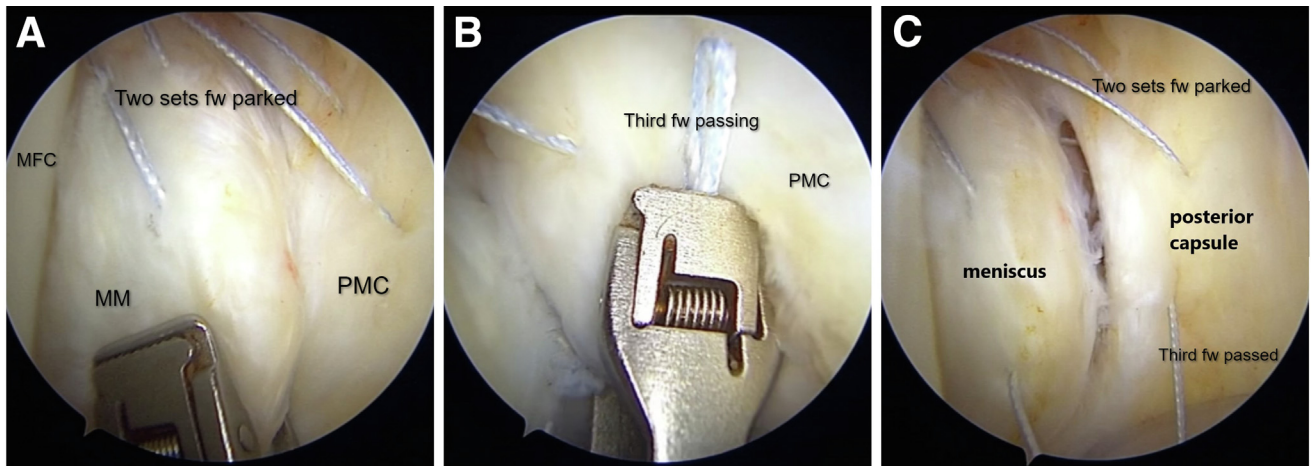
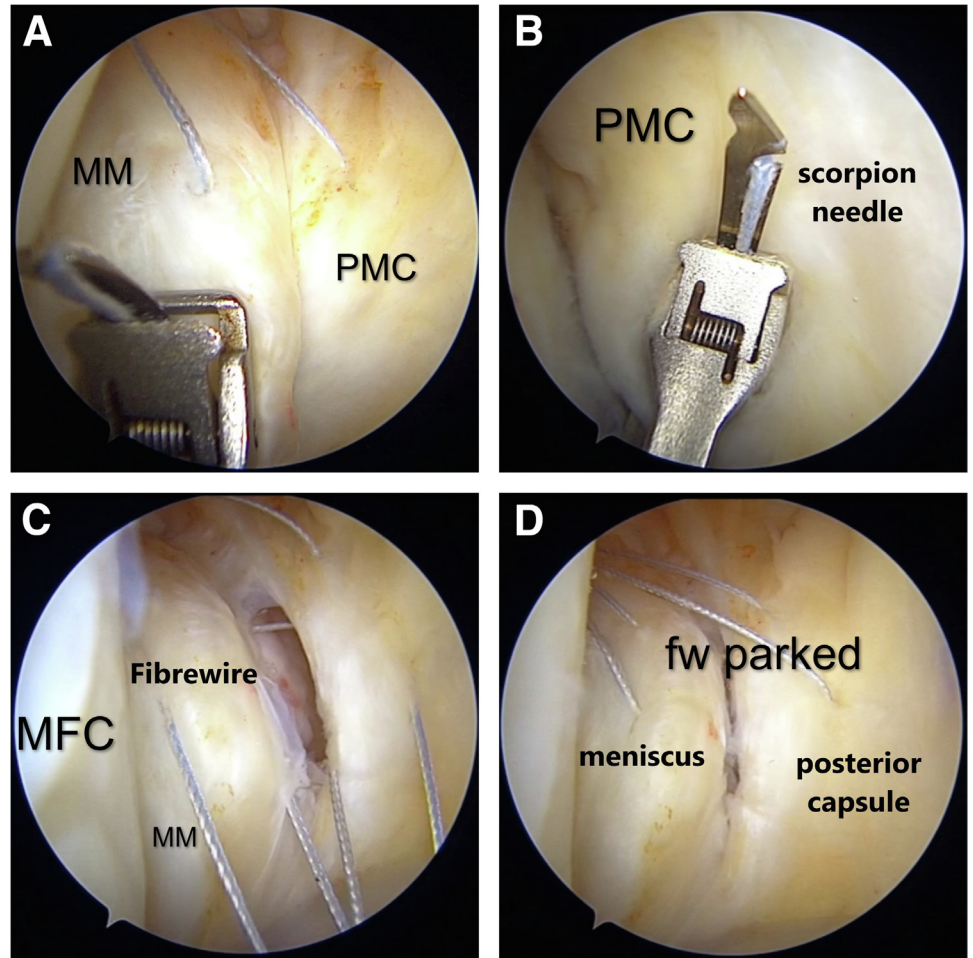


Fig 8. Right knee in 90° flexion: looking through the high posteromedial portal and instrumentation from the low posteromedial portal. (A) The fifth bite is taken from the meniscus using knee scorpion. (B) The sixth bite is taken from the posterior capsule. (C) All 3 sets of sutures can be seen: the first 2 parked in the anterolateral portal and the third coming from the low posteromedial portal approximation of the ramp lesion can be seen. (fw, FiberWire; MFC, medial femoral condyle; MM, medial meniscus; PMC, posteromedial capsule.)

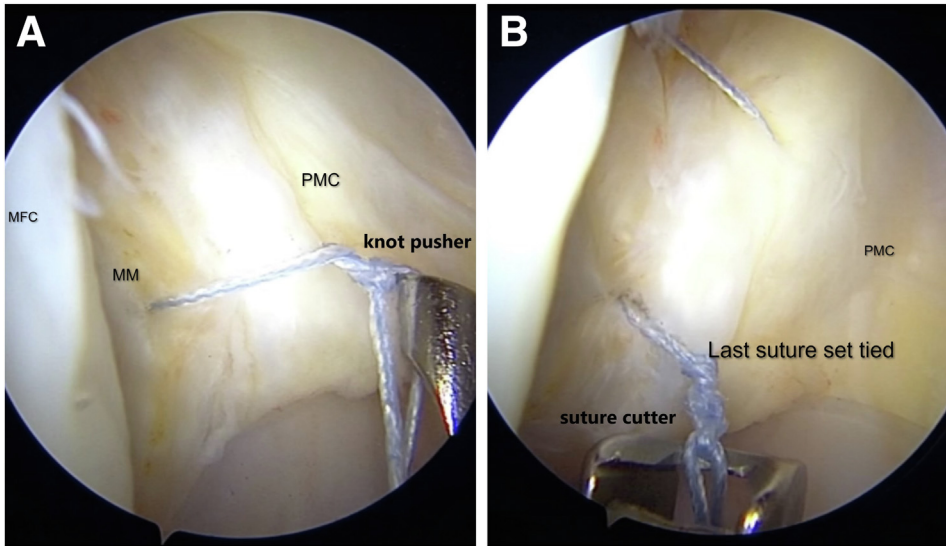
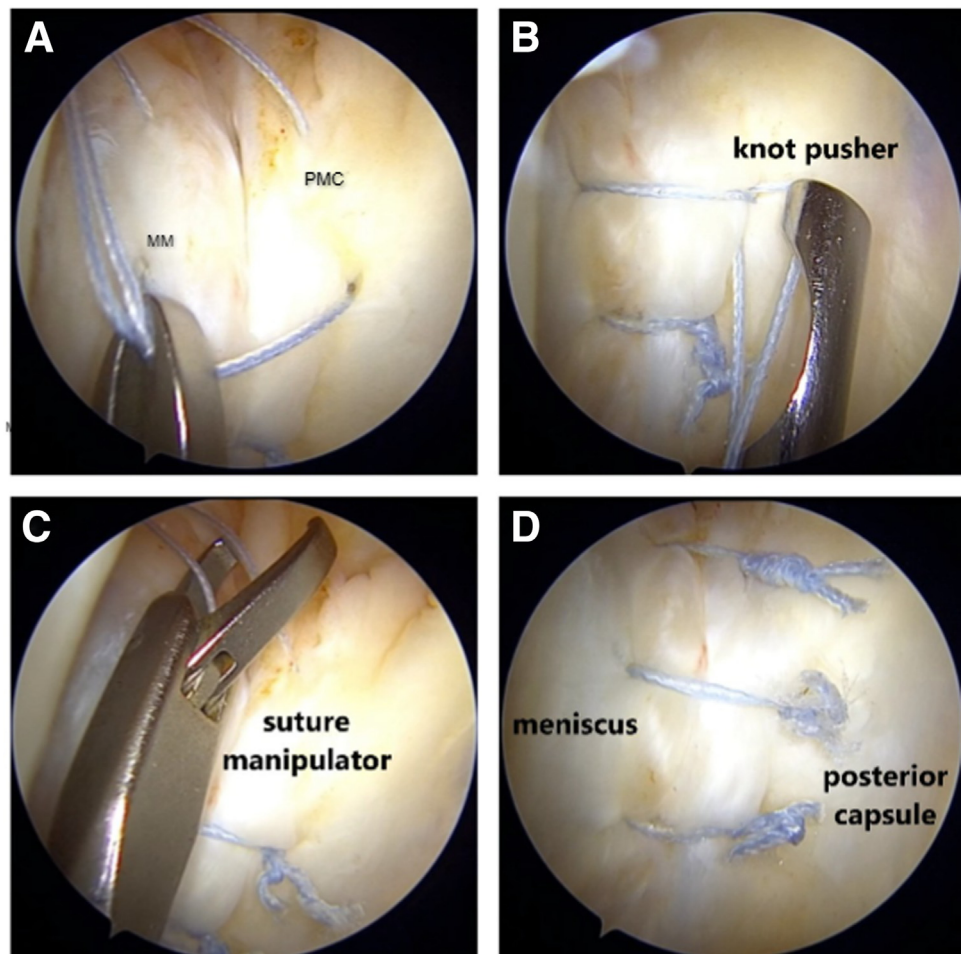


Fig 9. Right knee in 90° flexion: visualization through the high posteromedial portal and instrumentation from the low posteromedial portal. (A) Knot-tying using a knot pusher with multiple half hitches; the third set (most medial) is tied first. (B) Knot tied and cut using a suture cutter; approximation of the ramp lesion can be seen. (MM, medial meniscus; PMC, posteromedial capsule.)

capsule can be avoided. Knot-tying is started for the last suture passed, using a knot pusher (Fig 9a), and followed by a suture cutter once tying is done (Fig 9b).

Still the 2 sets of sutures are parked in AL portal, out of which middle set of sutures is retrieved from low PM portal (Fig 10a) and knot-tying done (Fig 10b),

Fig 10. Right knee in 90° flexion: looking through the high posteromedial portal and instrumentation from the low posteromedial portal. (A) second set of sutures (middle) are retrieved from the low posteromedial portal using a suture manipulator. (B) The second set knot-tying using a knot pusher. (C) The first set of sutures are retrieved from the low posteromedial portal and tied. (D) All 3 sets of knots are tied, and approximation of the ramp lesion can be seen. (MM, medial meniscus; PMC, posteromedial capsule.)



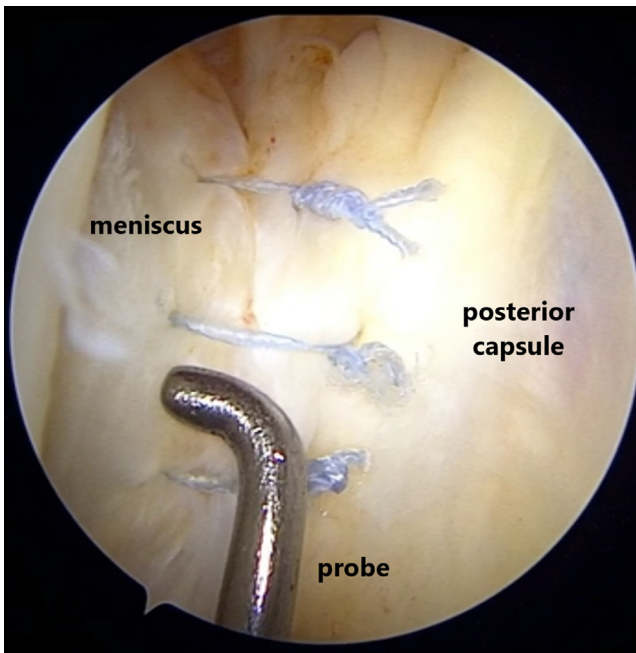


Fig 11. Right knee in 90° flexion: final picture after the repair visualization through the high posteromedial portal and probe from the low posteromedial portal, the ramp lesion is seen to be well approximated and stable.

ensuring that knot comes on the capsular side not on to meniscus side. This is followed by retrieving last set of sutures and knot tying (Fig 10 c and d). These sequential steps of pass, park each suture, and tie once all sutures are passed ensure good suture management and stable ramp repair. Finally, after the repair visualization through the high PM portal and probed from the low PM portal, the ramp lesion is seen to be well approximated and stable (Fig 11).

Postoperative Rehabilitation

From the next day, quadriceps isometric, ankle pumping, and hip rotation exercises are advised. Toe-touch weight-bearing and passive range of motion up to 45° are permitted in the first 2 weeks. From second

to fourth week, 0 to 90° of motion with partial weight-bearing is allowed. After 4 weeks, full weight-bearing and full range of motion are permitted. Return to greater activities is guided by associated ligament injury and varies from 3 to 6 months.

Discussion

Failure to diagnose ramp or inadequate repair may lead to failure of concomitant ACL reconstruction.⁶ Systemic arthroscopic exploration is therefore essential for identifying this hidden lesion.⁷ Hypermobility of the meniscal ramp during flexion and extension will prevent healing of ramp, necessitating the need of very stable repair.⁸

Various techniques are described for ramp repair, which include the inside-out repair,⁹ all-inside repair using fast T-fix,¹⁰ and fast fix.¹¹ The inside-out technique involves a long outside incision and possesses risk to neurovascular structures. The all-inside device technique is expensive and is done without proper visualization of both meniscus and capsule simultaneously.

Different techniques use different portals to visualize the ramp properly, which includes the standard anterior portal,¹² anterior portal with medial collateral ligament pie crusting,¹³ PM portal,¹⁴ and transeptal portal.¹⁵ The major drawback of visualization only from the anterior portal is that the true extent of ramp lesion cannot be assessed. Two PM portals give an added advantage not only for visualization of the full extent of the ramp but ease of repair from the low PM portal. Recently, 2-PM portal was described by Siboni et al.¹⁶; we have been using the same 2 PM technique for 4 years, but the repair is done using a Scorpion passer and all sutures are passed first and then sequential tying is done at the end.

Two essential steps in ramp surgery are identification of lesion's extension and its secure repair. The first step is achieved by 2 PM portals, giving a bird's eye view of the ramp, and second step by suture passage and repair while looking at both meniscus and capsule. Our technique covers both the steps to achieve fixation,

Table 1. Advantages and Disadvantages of a PM Antegrade Suture Technique Using the Knee Scorpion

Advantages	Disadvantages
<ul style="list-style-type: none"> • Technically simpler and easily reproducible • All-inside, low-cost, nonimplant surgery • Multiple sutures can be used • Less chance of injury to posterior structures • Less associated morbidity as compared with the inside-out technique • Use of PM portals allows better visualization of the extent of the tear, hidden lesions, better maneuvering, and repair • High healing rates • Strong repair construct 	<ul style="list-style-type: none"> • Risk of cartilage injury in tight medial compartment to the posterior aspect of femoral condyles. • Demands special instruments like the Scorpion Passer • May require medial release • Failure to heal or inappropriate rehabilitation can lead to changes knee biomechanics.

PM, posteromedial.

Table 2. Pitfalls and Tips for PM Antegrade Suture Technique Using Knee Scorpion

Pitfall	Tips
Entering the PM compartment is difficult in a tight knee	Use shaver from the transpatellar tendon portal and make space between ACL and PCL to enter in the PM compartment
Difficulty in making low PM portal	Transillumination circle at PM aspect with operation theater's lights off makes entry very easy
Finding the right trajectory for instrumentation through the low PM portal	Use of spinal needle before making the portal in such a way that it is at the level of meniscus and not too anterior
Passing of suture through meniscus with the Scorpion may be difficult	Use of flexion–extension movements will allow easy entry beneath the meniscus
Once the first suture is passed, subsequent sutures passage and management is difficult	Pass, park, tie: after passing first suture, park it in anterolateral portal without tying it. This will ensure easy subsequent passage and also will prevent suture entanglement

ACL, anteroposterior cruciate ligament; PCL, posterior cruciate ligament; PM, posteromedial.

which is stable with knee movements, ensuring good healing.

Our pass, park, and tie technique offers unique advantages (Table 1) in terms of excellent visualization, easy multiple suture passage, self-retrieving of the suture, direct view of knot-tying, and is a secure, stable, nonimplant, low-cost fixation. The learning curve for this technique can be shortened with the technical tips as given in Table 2.

References

- Espejo-Baena A, Espejo-Reina A, Espejo-Reina MJ, Ruiz-Del Pino J. The Finochietto sign as a pathognomonic finding of ramp lesion of the medial meniscus. *Arthrosc Tech* 2020;9:e549-e552.
- Chahla J, Dean CS, Moatshe G, et al. Meniscal ramp lesions: Anatomy, incidence, diagnosis, and treatment. *Orthop J Sports Med* 2016;4(7).
- Hatayama K, Terauchi M, Saito K, Takase R, Higuchi H. Healing status of meniscal ramp lesion affects anterior knee stability after ACL reconstruction. *Orthop J Sports Med* 2020;8(5).
- DePhillipo NN, Moatshe G, Brady A, et al. Effect of meniscocapsular and meniscotibial lesions in ACL-deficient and ACL-reconstructed knees: A biomechanical study. *Am J Sports Med* 2018;46:2422-2431.
- Thaunat M, Jan N, Fayard JM, Kajetanek C, et al. Repair of meniscal ramp lesions through a posteromedial portal during anterior cruciate ligament reconstruction: Outcome study with a minimum 2-year follow-up. *Arthroscopy* 2016;32:2269-2277.
- Stephen JM, Halewood C, Kittl C, Bollen SR, Williams A, Amis AA. Posteromedial meniscocapsular lesions increase tibiofemoral joint laxity with anterior cruciate ligament deficiency, and their repair reduces laxity. *Am J Sports Med* 2016;44:400-408.
- Sonnery-Cottet B, Conteduca J, Thaunat M, Gunepin FX, Seil R. Hidden lesions of the posterior horn of the medial meniscus: A systematic arthroscopic exploration of the concealed portion of the knee. *Am J Sports Med* 2014;42:921-926.
- Ahn JH, Kim SH, Yoo JC, Wang JH. All-inside suture technique using two posteromedial portals in a medial meniscus posterior horn tear. *Arthroscopy* 2004;20:101-108.
- DePhillipo NN, Cinque ME, Kennedy NI, et al. Inside-out repair of meniscal ramp lesions. *Arthrosc Tech* 2017;6:e1315-e1320.
- Chen Z, Li WP, Yang R, et al. Meniscal ramp lesion repair using the Fast-Fix technique: Evaluating healing and patient outcomes with second-look arthroscopy. *J Knee Surg* 2018;31:710-715.
- Negrín R, Reyes NO, Iñiguez M, Pellegrini JJ, Wainer M, Duboy J. Meniscal ramp lesion repair using an all-inside technique. *Arthrosc Tech* 2018;7:e265-e270.
- Mostafa Zaky Abdelrazek BH, Waly MR, Abdel Aziz MA, Abdel Aziz A. Different techniques for the management of meniscal ramp lesions using standard anterior portals. *Arthrosc Tech* 2019;9:e39-e44.
- Choi KY, Koh IJ, Kim MS, In Y. Medial meniscal ramp lesion repair through anterior portals using a medial collateral ligament pie-crusting technique. *Arthrosc Tech* 2021;10:e1073-e1077.
- Thaunat M, Fayard J-M, Freychet B, Vieira TD, Sonnery-Cottet B. Rationale and surgical technique of ramp lesion repair through an additional posteromedial portal. *Video J Sports Med* 2021;1.
- Buyukdogan K, Laidlaw MS, Miller MD. Meniscal ramp lesion repair by a trans-septal portal technique. *Arthrosc Tech* 2017;6:e1379-e1386.
- Siboni R, Pioger C, Jacquet C, et al. Meniscal ramp repair: A 2-portal posteromedial approach. *Arthrosc Tech* 2022;11:e1163-e1169.