

TOTAL OUTSIDE-IN REPAIR OF BUCKET-HANDLE MENISCUS TEAR: NOVEL, BALANCED AND COST-EFFECTIVE TECHNIQUE



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Abstract:

Bucket-handle tear is a common meniscal injury which requires arthroscopic reduction and repair for long term good functioning of the knee. For this various zone specific techniques have been described in literature. Outside-in meniscal repair technique is especially indicated for anterior horn and meniscus body tears. We here propose a novel total

an outside-in technique that is easy to perform, safe, balanced and also cost-effective for the repair of medial meniscus bucket handle tears.

Introduction:

Meniscus preservation has its importance in maintaining a healthy and well-active knee. It plays an important role in shock absorption, load distribution, and lubrication [1]. This explains why meniscus repair has gained an advantage in recent years.

Among all meniscus tears, Bucket-handle meniscus tears account for almost 10% tears. They comprise a vertical or oblique tear with a torn and displaced central fragment from the periphery into the intercondylar notch. Some of the difficulties in treating these kinds of tears are the size of the central fragment, quality of meniscal tissue, challenges in fragment reduction, and stabilization for healing. Also, regional differences in its zonal blood supply vary the treatment outcome (2).

Although early symptoms may be relieved by partial or subtotal meniscectomy, long-term increased tibia-femoral contact pressure may lead to early arthritis in the affected knee. Meniscus repair preserves knee biomechanics [3,4]. Arthroscopic repair techniques can be categorised as: inside-out, outside-in, all-inside. Technical considerations can be there in cases of inside-out techniques like the requirement of extra trained assistants for passing sutures, neurovascular complications especially saphenous nerve palsy, and safe incision.



Fig 1: Diagnostic Arthroscopy views (a) From Antero-lateral portal, the displaced central fragment of BHT of the medial meniscus (MM) in intercondylar notch, (b) Bucket handle tear of medial meniscus, (c) view from transpatellar portal -reducing the fragment back of BHT and held with a probe, [*BHT – Bucket Handle Tear, *MM – Medial meniscus *ACL – Anterior Cruciate Ligament, *MFC- Medial Femoral Condyle, *MTP- Medial Tibia Plateau]

The all-inside technique has its limitations like expensive meniscus repair devices and a longer learning curve [5].

Our aim here is to describe the novel total outside-in technique for the Bucket handle tear (BHT) of Medial Meniscus, which is a balanced technique with the added advantage of cost-effectiveness.

Surgical Technique:

Surgical Indications:

Any symptomatic BHT of the medial meniscus that can be reduced successfully anywhere from the anterior third to the posterior horn of the meniscus and have good potential to heal are the indications for total outside-in meniscus repair technique.

Patient Positioning and Preparation:

The patient is positioned supine with the leg hanging down with thigh support for applying valgus stress force. A well-padded thigh tourniquet is placed. After spinal anesthesia, a bilateral knee examination is done and the injured knee is compared with the uninjured knee. The operative leg is then prepped and draped in the usual sterile fashion.

Diagnostic Arthroscopy:

Arthroscopy was done using standard anterolateral (AL) and anteromedial (AM) portals. In our case, the 30-degree arthroscope was inserted through the AL portal to evaluate the meniscus and any other associated intra-articular pathology like an ACL tear. The BHT of the medial meniscus was then evaluated for the extent, pattern, complexity. The preliminary reducibility was then checked with attempts to reduce the fragment toward the desired anatomical position with the probe and was found to be well reducible(Fig 1).

Total Outside-In Bucket Handle Meniscal tear repair:

After diagnostic arthroscopy, fat pad and peri-meniscal granulation debridement is done by arthroscopic shaver and rasp. Pie crusting is done to open posteromedial joint space allowing better visualization of the meniscus. The torn central fragment is reduced by the probe. The 18G spinal needle is passed from outside the capsule towards the joint and perpendicular to the tear line within the superior surface of the middle body of the meniscus. Metallic shuttling wire (Chia-Mitek) is passed through the needle and held by the grasper, passed through the transpatellar tendon portal(Fig 2).

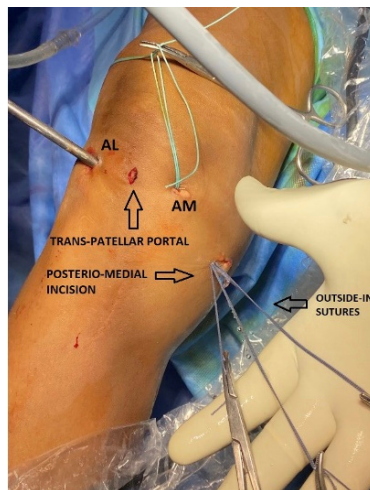


Fig 2: Arthroscopy portals and posteromedial incision for passing sutures through outside-in technique [*AL – Anterolateral portal, *AM- Anteromedial portal]

Thereafter, the needle is withdrawn to the outer membrane of the capsule (the space between the capsule and subcutaneous tissue) while the wire is still within the needle. Horizontal incision of approx. 2-2.5 cm given over posteromedial joint line incorporating the exit of metallic wire. The free end of the non-absorbable suture (orthocord no 2) is then pulled through the loop of wire retriever and pulled back out of the knee. The same steps are repeated creating a horizontal mattress suture construct. This central suture is used as a traction suture to hold the meniscus in anatomical position. Next mattress sutures with the outside-in technique are passed near the posterior horn of the medial meniscus superior surface applying valgus stress and slight external rotation of the tibia. Similar horizontal mattress sutures are then passed from posterior to anterior direction engaging the superior surface of the torn meniscus. Sliding knots are tied from posterior to anterior flush to the medial capsule.

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Postoperative Protocol:

The patient is placed in a knee brace for 3 weeks with isometric quadriceps exercises. Partial weight-bearing is allowed after 3 weeks and full-weight bearing is allowed after 6 weeks. The patient is followed at 6 months and is found to have gained a full range of movements at the knee and could perform all daily routine activities without any support. Sports activities are generally permitted about 9 months after repair, depending on the patient's progress in strength and agility recovery.

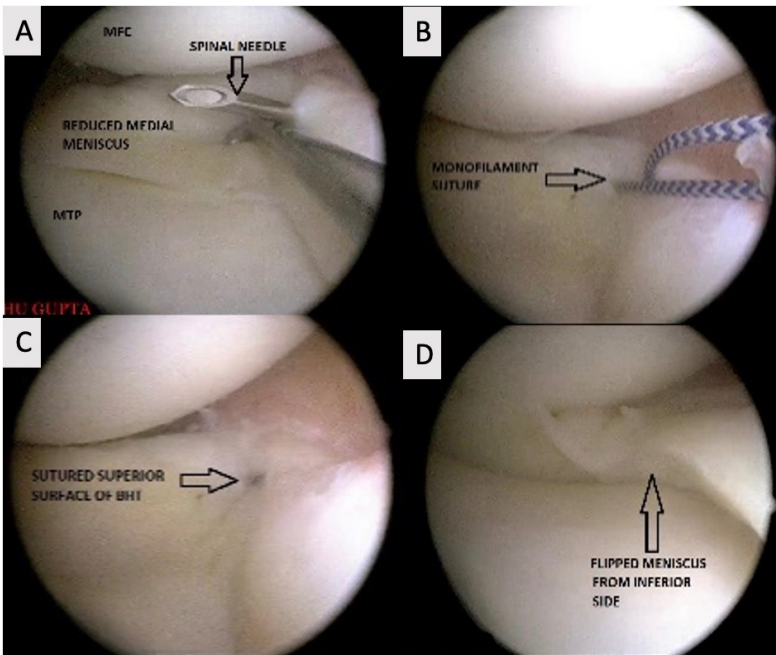


Fig 3: Arthroscopic view from transpatellar portal. (a) Spinal needle passing over the superior surface of tear, (b) Monofilament suture passing through the tear in horizontal mattress configuration (c) first central horizontal mattress stitch acting as traction stitch and helping in reducing BHT (d) flipping of meniscus from under surface.

Discussion:

Previous studies have well described the role of an arthroscopic meniscus repair, especially in peripheral vertical longitudinal tears compared to meniscectomy that had resulted in early degenerative changes [6,7]. Different techniques have been described for meniscal repair – outside-in, inside-out, all-inside. The all-inside technique has gained popularity for small tears that need few stitches, ease of use, shorter surgery time, no risk of nerve involvement, and less surgical assistance required. There are limitations of its use in large tears as the high cost of the device may limit the number of sutures. The Inside-out repair was considered to be the gold standard for these tears but it requires safety incisions, extra trained assistants for passing sutures, and have neurovascular, soft-tissue complication concerns also[8].

Hantes et al. compared the results of meniscal repair with outside-in, inside-out, and all-inside techniques and observed meniscal healing in 100%, 95%, and 65% patients, respectively [9]. A meta-analysis study of arthroscopic meniscal repair comparing all the above techniques was done recently and had established that the inside-out technique had a significantly higher mean operating time than the all-inside technique. The outside-in technique came out to have a significantly higher mean rate of meniscal healing than the all-inside repair [10].

The total outside-in technique gave us the advantage of better control of the angle of approach as the procedure was done by the use of a spinal needle for putting sutures. Thus no auxiliary incisions were required. This technique is also relatively safe as neurovascular structures are far away from the incision. This is evident from the study of Sobhy M.H. et al in which

they had evaluated the risk of neurovascular injury and clinical outcome of their posterior approach in outside-in repair of a tear in the posterior horn of the medial meniscus. They did a cadaveric study on 6 knees and had made an entry point just lateral to the Semitendinosus tendon.

Their results showed that the Popliteal bundle was almost 2.4 cm and the Saphenous nerve was almost 4.6 cm away from this entry point. They followed patients for 27 months and got 88% clinically satisfactory results [11]. Al-Fayyadh et al did their study for evaluating the risk of popliteal artery injury in the all-inside meniscal repair of posterior lesions. They had also concluded that the posterior horn of the medial meniscus was approximately 15 to 20 mm from the neurovascular bundle and on the lateral side 10mm away from the neurovascular bundle [12]. In a study by Morgan and Casscells which evaluated clinically their patients who underwent outside-in repair for posterior horn tears, the

authors reported 98% good to excellent clinical outcomes [13]. We got multiple fixation points that helped in getting better stability and doing better balancing of the meniscus since sutures were also put on the under-surface of the meniscus. Further, this technique is cost-effective since no costly implant or suturing device was needed except shuttling wires and spinal needle.

There were also some difficulties in performing this technique as sutures had to be implicated in the perpendicular orientation to the tears that were adjacent to the site of attachment of the posterior horn. Also, we needed to do Pie crusting of the Medial collateral ligament (MCL). Another thing to be kept in mind was the risk of suture knot impingement as in this kind of case one needs to put seven to eight sutures. There was a risk of injury to posterior neurovascular structures if landmarks were strictly not followed. The manoeuvre of excess valgus force may cause iatrogenic MCL ligament injury. One has to be careful in piercing the needle for the multiple sutures as it may cause chondral lesions.

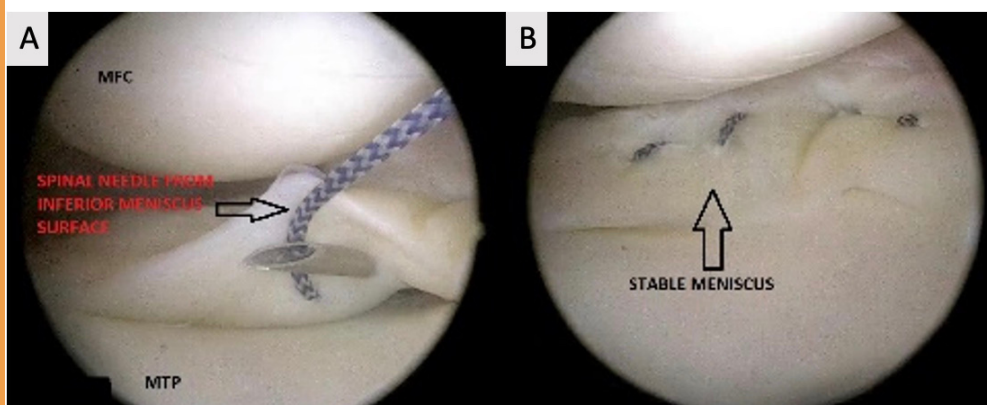


Fig 4: View from transpatellar portal: (a)spinal needle from inferior surface reducing the flipped meniscus part, (b) reduced stable medial meniscus after tightening all horizontal mattress suture construct by outside-in technique.

Despite the safety and reproducibility of the described technique, it has its limitations, this procedure could be difficult in the case of BHT of the lateral meniscus. There can also be difficulty in getting safe landmarks and proper orientation for putting needles in cases of obese patients and patients with previous ACL reconstruction done by use of ST (semitendinosus) auto-graft.

Further study with a long-term follow-up period and further study of a control group will substantially justify our results.

Conclusion:

The total outside-in repair technique was thus found to be safe, balanced, and cost-effective in bucket handle tear of the medial meniscus at any zone.

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