Section: Orthopedics

Original Research Article

TO STUDY THE FUNCTIONAL OUTCOME OF TRANSTIBIAL PULLOUT TECHNIQUE FOR POSTERIOR MENISCAL ROOT TEAR IN EARLY OSTEOARTHRITIS

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Abstract

Background: Osteoarthritis (OA) of the knee is a prevalent degenerative condition affecting various structures of the knee joint, with meniscal root tears being a significant yet often undiagnosed contributor to its progression. The objective is to study the comparison between functional outcomes before and after transtibial root repair for the treatment of posterior horn root tears of meniscus in early osteoarthritis. **Materials and Methods:** A prospective study was conducted at BLDE (Deemed to be University) Shri B. M. Patil Medical College, Hospital & Research Centre, Vijayapura, from August 2022 to December 2024. A total of 35 patients (aged 40-55) underwent arthroscopic meniscus posterior horn root repair. Patient demographics, injury history, clinical and radiological findings and intra-operative findings were documented. VAS and WOMAC scores were assessed pre-operatively and at 3, 6, and 12 months post-operatively. **Result:** The study included 35 patients (77.1% female, 22.9% male). Age distribution was as follows: 42.9% were below 45 years, 37.1% were between 45-49 years, and 20% were over 50 years. Right limb involvement was observed in 60% of cases. 42.9% had a history of trauma. Intra-operatively, type 2 tears were found in 48.6%, type 4 in 8.6%, and type 5 in 42.9%. VAS scores significantly decreased from a mean of 7.26 pre-op to 2.11 at 12 months post-op (P = 0.001). WOMAC scores also significantly decreased from a mean of 45.54 pre-op to 4.80 at 12 months post-op (P = 0.001). MRI findings showed 20% of cases involved the lateral meniscus and 80% involved the medial meniscus. **Conclusion:** Early surgical repair of meniscal root tears using the transtibial pull-out technique significantly improves functional outcomes and reduces pain in patients with early osteoarthritis. These findings support the importance of early diagnosis and intervention in managing meniscal root tears to slow the progression of osteoarthritis.

INTRODUCTION

Osteoarthritis of knee is one of the most prevalent degenerative diseases affecting the musculoskeletal system. This condition impacts the entire knee joint, affecting structures such as the articular cartilage, subchondral bone, synovium, ligaments, and meniscus. The global prevalence of OA knee is estimated to be 16.0%. Incidence is 203 cases per 10,000 person-years. It affects 10% of men and 13% of women over 60 years of age.[1]

The meniscus is a fibrocartilaginous, crescent-shaped structures with triangular cross sections that cover 70% of the articular surface of the tibial plateau. It is a fundamental component of the intricate biomechanical system of the knee. By increasing the contact surface area and ensuring even weight distribution across the articular surfaces, the

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meniscus plays a critical role in dispersing and absorbing the force load on weight bearing.

Meniscal root tears, sometimes referred to as a "silent epidemic," are difficult to diagnose and, if left untreated, can progress rapidly to osteoarthritis (OA). They frequently remain undetected and account for 10–21% of all meniscal tears. A meniscal root tear can occur as a whole root avulsion or as a radial tear within 9mm of the root attachment. These tears result in meniscal extrusion and alter the load distribution, which increases contact pressure and can cause insufficiency fractures (previously known as spontaneous osteonecrosis of the knee {SONK}, now termed subchondral insufficiency fracture {SIFK}). These tears also impair the meniscus's ability to convert tibiofemoral loads into hoop stresses.[2]

In addition, medial meniscus posterior root tears (MPRTs), which are 5.8 times more likely to be associated with knee chondral abnormalities than lateral meniscus posterior root tears (LPRTs), are 10.3 times more likely to occur in conjunction with ACL tears. Up to 21.5% of posterior horn medial meniscus tears are thought to be caused by medial meniscus posterior root tears, which are predominantly seen in middle-aged women and frequently degenerative.[3]

Meniscus damage alters the load distribution pattern and increases the risk of compartmental instability. Early osteoarthritis develops as a result of these alterations that harm the articular cartilage.[4]

Osteoarthritic knees can also result in a spontaneous meniscal tear and extrusion through breakdown and weakening of meniscal structure.[5]

Historically, meniscal root tears were treated with total or partial meniscectomy to achieve short-term benefits. Currently, suture anchor repair (SA) and transtibial pull-out repair (TP) are two current methods for refixing the tears in the posterior meniscus root (PMMR).[6]

Root repairs have been reported to be the treatment of choice that improves clinical outcome, decreases meniscal extrusion and slows down the onset of degenerative changes.[7,8]

Transtibial repairs of meniscal root tears have a reportedly low failure rate, with an observed revision rate of 6.7%.[9,10]

Arthroscopic transtibial pullout is the technique used most commonly for achieving adequate root fixation. The purpose of this study is to review the scant literature on meniscal root tears and to investigate the impact of early surgical repair using the transtibial pull-out technique on reducing the progression of osteoarthritis (OA)in conjunction with VAS and WOMAC scoring system.

MATERIALS AND METHODS

This Prospective study was conducted in BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil Medical College, Hospital & Research Centre, Vijayapura from 1st August 2022 to 31st December 2024.

In our study, 35 patients were involved, of whom 8 (22.9%) were male and 27 (77.1%) were female. 15 patients (42.9%) sustained injury.A minimum of 12 months and a maximum of 17 months of follow-up achieved.

All middle-aged patients who presented to the orthopedic outpatient departments at the BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil Medical College, Hospital & Research Centre, Vijayapura with complaints of knee pain, difficulty walking and performing regular tasks were examined thoroughly. The affected knee was assessed after the unaffected knee was checked.

A thorough history was taken, and clinical examination was performed. Local examination included inspection, palpation and range of movement assessment.

To identify the meniscus injury, the following particular tests were carried out:

McMurray’s test

Apley’s grinding test

Thessaly test

Ligament injury assessment was done:

- Valgus & Varus-stress test (Collateral ligaments)
- Lachman’s and anterior drawer test (ACL)
- Posterior Drawer (PCL)
- Regular X-rays of the afflicted knee were taken in both lateral and anteroposterior views.
- For confirmation, an MRI of the knee was performed in every case where meniscal injury was suspected.

Inclusion Criteria

- Patients aged between 40 to 55 years.
- Clinical examination and radiographic confirmation for osteoarthritis changes.
- Clinical and MRI confirmed posterior meniscal root tears.
- Non-traumatic and traumatic meniscal root tears in patients without severe degeneration
- (Kellgren- Lawrence grade 1 & 2)
- Patients willing for treatment and giving informed and written consent.

Exclusion Criteria

- Patients aged below 40 years and above 55 years.
- Uncorrected varus or valgus malalignment (>3 degrees)
- Osteoarthritis of knee (Kellgren- Lawrence grade 3 & 4)
- Multiple Ligament injuries of knee.
- Associated neurovascular injury.
- Diffuse articular cartilage changes International Cartilage Regeneration and Joint Preservation Society (ICRS) grade 3 & 4.
- Patients medically unfit for surgery.

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Statistical analysis: The data obtained will be entered in a Microsoft Excel sheet, and statistical analysis will be performed using statistical package for the social sciences (Version 20).
Results will be presented as Mean±SD, Median and interquartile range, frequency, percentages and diagrams.

Surgical Technique

In each case, a preoperative dose of ceftriaxone + sulbactam (1.5 g) is administered as a preventive antibiotic measure.
In our study, position of the patient was supine. Side post over the upper 1/3rd of affected thigh to prevent abduction and a post fixed on table to keep the knee in 70-90 degrees of flexion.
Under ascetic precautions spinal/epidural anesthesia was given. Tourniquet applied, exsanguinated before inflating

Figure 1: Positioning of patient.

Diagnostic arthroscopy: After skin marking, anterolateral port (viewing portal) is created with no. 11 blade at the level of the inferior pole of the patella, directly lateral to the patellar tendon, when the knee is flexed 90 degrees. Next, the scope is put in for diagnostic arthroscopy. Normal saline is used to insufflate the joint, and a 30 degree arthroscopy camera is used to see it. All intra-articular structures were visualised for any abnormality. Posterior horn of meniscus root tear is identified.
The anteromedial (working) portal is then established when all abnormalities have been noted.
Probing is done to confirm the diagnosis.
Debridement of hypertrophied synovium, articular cartilage from the posterior aspect of medial or lateral femoral condyles.
Pie-crusting of the medial collateral ligament using an 18G needle was done in case of a tight medial compartment which helps in widening it. By applying valgus load close to full extension (5°–10° flexion angle), the posterior horn of the medial meniscus can be better visualised.

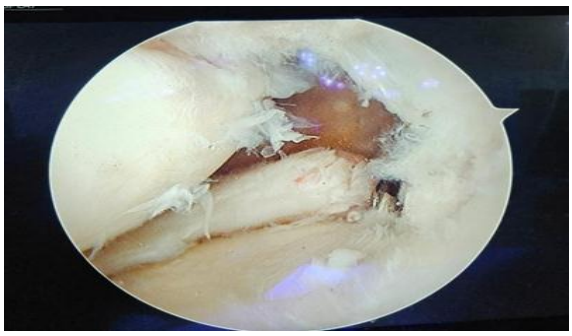

Figure 2: Intraoperative finding of posterior of meniscus root tear.

Tibial Tunnel preparation[8]: The transtibial tunnel incision of 2-3cm is made antero-laterally, just distal to the medial portion of Gerdy's tubercle, for lateral meniscus posterior horn root tears, and just medial to the tibial tubercle and proximal to pes anserinus, for medial meniscus posterior horn root tears.
A tibial aiming jig is placed with a cannulated sleeve. A drill guide is used to ream and position is confirmed. Using a 4.5mm and 8mm reamer, guide wire is over drilled.
Suturing the torn menisci: A non-absorbable braided suture (Fibre Wire No.2/No.0) is loaded to a suture-passing device (Scorpion, First Pass). Through the antero-medial portal, this device is inserted and suture is passed 3-5mm away from the torn end. Another suture is passed next to it for better stability and fixation. Pull the fibre wire ends out and make a loop and create a Mickey's ear stitch outside the portal.
A nitinol passing wire/ Ethibond is passed through the tibial tunnel into the joint as a loop. With a probe or a grasper, the fibre wire is passed into the loop. Now the ethibond is pulled back out through the tibial tunnel. By doing this, the meniscus root is reduced into the tibial socket by tensioning the free ends of the sutures. Tibial fixation is done by tying it to a suture button (e.g. Endo button/ Suture disc/ MR-Fix) or with a suture anchor.

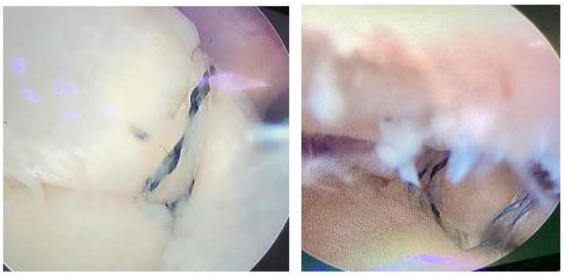

Figure 3: Showing suturing of torn root of posterior horn meniscus using Fibre wires No 2.

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Figure 4: Transtibial tunnel, through which the fibre wire is retrieved and fixed using an MR-Fix.

RESULTS

35 cases of arthroscopic meniscus posterior horn root repair were randomized and were followed up regularly for a period of 12 months minimum and 17 months maximum in BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil Medical College, Hospital & Research Centre, Vijayapura (August 2022 to January 2024).

All patients taken for the study were in between 40 to 55 years of age, out of which 15 (42%) patients were below 45 years, 13 (37%) were between 45-49 years, 7(20%) were over 50 years.

Out of 35 cases, females were 27 (77%) and males were 8(23%).

Limb involvement on the right side accounted to be 21 (60%) and left was 14 (40%)

In our study, total number of patients who gave history of trauma such as fall or twisting injury were 15 (43%) and those without any mode of injury were 20 (57%).

Intra-operatively, we found that 17 (49%) of the cases belonged to type 2, 3 (9%) to type 4 and 15 (43%) belonged to type 5.

After interpreting the VAS score pre-op and post-op at 3,6 and 12 months period, we can see that there is a significant decrease in the VAS score suggesting and the comparison has given us a P-value of 0.001 which is significant.

After interpreting the WOMAC score pre-op and post-op at 3,6&12 months period, we can see that there is a significant decrease in the WOMAC score suggesting and the comparison has given us a P-value of 0.001 which is significant.

No of cases involving the lateral and medial meniscus were 7(20%) and 28(80%) respectively.

Table 1: post- operative management and rehabilitation.

Time period	Rehabilitation protocol
0-2weeks	Strict non-weight bearing walker mobilization for 4 weeks Use of Long knee brace/ Extension brace. Quadriceps strengthening started from first day (static), dynamic and Straight and side leg raise as per tolerated with brace. Electric stimulation if poor strength of quadriceps. Mobilisation of Patella (superior-inferior and Medio-lateral direction) Ankle pumps Passive range of motion exercises from 0º to 90º flexion started on Day 1 of surgery.
2-4weeks	Knee flexion can be increased as tolerated. Continue Quadriceps strengthening (static & dynamic) and Straight and side leg raise as per tolerated with brace with ankle pumps.
4-6 weeks	Partial/ Toe-touch weight bearing started. Dynamic Quadriceps strengthening and Straight and side leg raise
>6 weeks	Full weight-bearing begins progressively. Partial/ half squats.
>4 months	Deep leg presses and squats exceeding 70º of knee flexion.
>6 months	Running, Jogging, Swimming.

Table 2: Sustained injury or not.

Injury	No. of patients	Percentage
-	20	57.1
+	15	42.9
Total	35	100.0

Table 3: Intra-operative confirmation of type of root tear.

Intra-operative finding: Type of tear	No. of patients	Percentage (%)
2	17	48.6
4	3	8.6
5	15	42.9
Total	35	100.0

Table 4: VAS scoring system interpretation

VAS SCORE	Mean	Std. Deviation	25th	50th (Median)	75th	Friedman Test	P-Value
PRE-OP	7.26	.701	7.00	7.00	8.00	103.696	.0001
3 MONTHS	5.31	.718	5.00	5.00	6.00		
6 MONTHS	4.37	.731	4.00	4.00	5.00		
12 MONTHS	2.11	1.105	2.00	2.00	3.00		

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Table 5: WOMAC scoring system interpretation

Womac Score	Mean	Std. Deviation	25th	50th (Median)	75th	Friedman Test	P-Value
PRE-OP	45.54	2.873	44.00	46.00	48.00	105.000	.0001
3 MONTHS	35.37	3.020	32.00	36.00	38.00		
6 MONTHS	20.57	2.973	20.00	20.00	22.00		
12 MONTHS	4.80	2.286	2.00	4.00	6.00		

Table 6: MRI impression

MRI Findings	No. of patients	Percentage
Lateral meniscus posterior horn root tear	7	20.0
Medial meniscus posterior horn root tear	28	80.0
Total	35	100.0

Complications: 2 patients were noted to have superficial infection in our study they were treated with IV Antibiotics and improved.

3 patients complained of restricted range of movement due to poor compliance to post operative rehabilitation and pain intolerance. These patients were given aggressive physiotherapy along with adequate analgesics coverage and range of movements was achieved.

Case Illustrations

Case 1: A 41-year-old female diagnosed with left knee medial meniscus posterior horn root tear and underwent arthroscopic medial meniscus repair using transtibial pull-out technique and fixation was done using MR-Fix.

Figure 5: Pre-operative x-ray

Figure 6: MRI showing Medial meniscus posterior horn tear (Ghost Sign)

Figure 7: Clinical pictures of post-op patient.

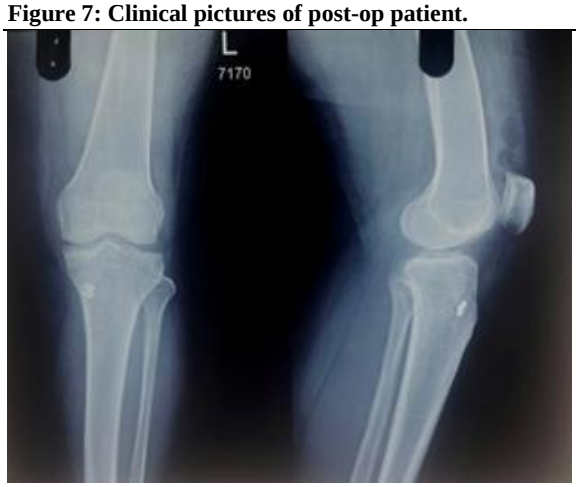

Figure 8: Post-operative meniscus root repair using transtibial pull-out technique with MR-Fix

DISCUSSION

The exploration of functional outcomes following posterior meniscal root repairs employing the trans-tibial pullout technique provides valuable insights, particularly when comparing findings across diverse studies. Our research conducted at BLDE (Deemed to be University) Shri B. M. Patil Medical College, Hospital & Research Centre, Vijayapura, between August 2022 and January 2024, involved 35 participants undergoing this surgical procedure. This analysis emphasizes the demographic characteristics, clinical outcomes, and intra-operative findings, fostering a comprehensive understanding of the technique's efficacy across different patient settings.

Our study predominantly comprised middle-aged females (77%), mirroring the demographic profile observed in the study by Feucht et al., where 83% of

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the participants were female. This demographic trend underscores potential gender-specific considerations in postoperative care and rehabilitation strategies due to the higher susceptibility of females to meniscal injuries.[8] Unlike the study done by Aaron J. Krych et al,[9] which did not detail gender distribution but noted significant clinical improvements regardless of demographic variables such as age and BMI, our findings also indicated that these factors were non-influential.[10]

The age profile in our study, spanning from 40 to 55 years, closely aligns with the mean patient age of 55 years reported by Feucht et al., suggesting the trans-tibial pullout technique's consistent effectiveness across a similar demographic. This is particularly pertinent given the rising incidence of degenerative meniscal lesions in this age group.[8]

Regarding trauma history, 43% of our patients reported incidents such as falls or twisting injuries, highlighting the role of acute injuries in meniscal tears. This aspect of patient history could potentially affect the preoperative meniscal condition and subsequently influence post-repair prognosis.

Intraoperatively, the majority of the meniscal tears we addressed were type 2 (49%), followed by type 5 (43%). This indicates the complexity of the cases handled and may impact the surgical approach and expected recovery outcomes. In the studies done by Feucht et al. and Aaron J. Krych et al., however, did not provide detailed breakdowns of tear types, focusing more broadly on the overall efficacy of the repair technique in enhancing clinical scores and halting osteoarthritic progression.[8,10]

Our results demonstrated significant improvements in VAS and WOMAC scores postoperatively, corroborating the findings from the multicenter study done by Aaron J. Krych et al,[9] which also documented substantial clinical improvements at 2 years. This consistency across studies highlights the trans-tibial pullout method's capacity to facilitate significant functional recovery.[10] The systematic review by Feucht et al. further supports this, with additional evidence showing the procedure's capability to arrest osteoarthritic progression, although they noted that complete healing and reduction of meniscal extrusion were less predictable, occurring in about 60% of cases.[8]

Surgeons are still debating whether older patients should have meniscectomy or root repair. In a different comparative cohort study, Chung K S et al., found that patients with an average age of 55 who had posterior medial root meniscectomy as opposed to root repair fared better than expected. The repair cohort's scores improved by 32 points from preoperative to postoperative status, while the meniscectomy cohort's improvement was only 12 points.[11]

Despite our study and the multicenter research by Aaron J. Krych et al, not finding a direct correlation between meniscal extrusion and poorer functional outcomes, literature from Feucht et al., suggests that progressive extrusion is associated with worse clinical outcomes and more severe osteoarthritic changes over time. This discrepancy may be due to differences in the follow-up durations and methods employed in assessing extrusion and its clinical impacts.[8,10]

CONCLUSION

As demonstrated by the VAS and WOMAC scores, the transtibial pull-out approach for the treatment of meniscal posterior horn root injuries substantially improves pain and functional outcomes. For patients with meniscal injuries, this procedure provides a dependable option that can significantly improve joint functionality and reduce pain. It is especially beneficial for female patients under 50 years of age. Variations in outcomes are likely influenced by patient-specific factors such as age and the extent of meniscal extrusion. This approach has to be further investigated and improved in the future in order to maximise its application and optimise recovery protocols for a variety of patient demographics.In conclusion, the comparative analysis of these studies affirmatively supports the effectiveness of the trans-tibial pullout technique in managing posterior meniscal root tears in patients with early osteoarthritis of knee.

REFERENCES

1. Cui A, Li H, Wang D, Zhong J, Chen Y, Lu H. Global, regional prevalence, incidence and risk factors of knee osteoarthritis in population-based studies. EClinicalMedicine. 2020 Dec 1;29.
2. LaPrade RF, Floyd ER, Carlson GB, Moatshe G, Chahla J, Monson JK. Meniscal root tears: Solving the silent epidemic. Journal of Arthroscopic Surgery and Sports Medicine. 2021 Jan 10;2(1):47-57.
3. Matheny LM, Ockuly AC, Steadman JR, LaPrade RF. Posterior meniscus root tears: associated pathologies to assist as diagnostic tools. Knee Surgery, Sports Traumatology, Arthroscopy. 2015 Oct;23:3127-31.
4. Persson F, Turkiewicz A, Bergkvist D, Neuman P, Englund M. The risk of symptomatic knee osteoarthritis after arthroscopic meniscus repair vs partial meniscectomy vs the general population. Osteoarthritis and cartilage. 2018 Feb 1;26(2):195-201.
5. Foreman SC, Neumann J, Joseph GB, Nevitt MC, Liu F, Lynch JA, McCulloch CE, Lane NE, Link TM. Accelerated knee osteoarthritis is nearly always associated with meniscal breakdown: Data from the osteoarthritis initiative. Osteoarthritis and Cartilage. 2018 Apr 1;26:S443-4.
6. Feucht MJ, Grande E, Brunhuber J, Rosenstiel N, Burgkart R, Imhoff AB, Braun S. Biomechanical comparison between suture anchor and transtibial pull-out repair for posterior medial meniscus root tears. The American journal of sports medicine. 2014 Jan;42(1):187-93.
7. Faucett SC, Geisler BP, Chahla J, Krych AJ, Kurzweil PR, Garner AM, Liu S, LaPrade RF, Pietzsch JB. Meniscus root repair vs meniscectomy or nonoperative management to prevent knee osteoarthritis after medial meniscus root tears: clinical and economic effectiveness. The American journal of sports medicine. 2019 Mar;47(3):762-9.
8. Feucht MJ, Izadpanah K, Lacheta L, Südkamp NP, Imhoff AB, Forkel P. Arthroscopic transtibial pullout repair for posterior meniscus root tears. OperOrthopTraumatol. 2019 Jun 1;31(3):248-60.
9. Krych AJ, Song BM, Nauert III RF, Cook CS, Levy BA, Camp CL, Stuart MJ, Smith PA. Prospective consecutive clinical outcomes after transtibial root repair for posterior meniscal

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root tears: a multicenter study. Orthopaedic Journal of Sports Medicine. 2022 Feb 24;10(2):23259671221079794.
10. Chung KS, Ha JK, Yeom CH, Ra HJ, Jang HS, Choi SH, Kim JG. Comparison of clinical and radiologic results between partial meniscectomy and refixation of medial meniscus posterior root tears: a minimum 5-year follow-up. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2015 Oct 1;31(10):1941-50.
11. LaPrade RF, Matheny LM, Moulton SG, James EW, Dean CS. Posterior meniscal root repairs: outcomes of an anatomic transtibial pull-out technique. The American journal of sports medicine. 2017 Mar;45(4):884-91.

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