Original Article

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Orthopaedics Section

Arthroscopic Meniscal Repair and Partial Meniscectomy in Degenerative Meniscal Tears: A Comparative Study on Pain Relief, Functional Outcomes and Postoperative Complications

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ABSTRACT

Introduction: Osteoarthritis (OA) of the knee is a progressive joint disorder, with degenerative meniscal tears being a common contributing factor. Surgical interventions such as Arthroscopic Meniscal Repair (AMR) and Arthroscopic Partial Meniscectomy (APM) are widely performed; however, their long-term impact on joint health remains a topic of debate.

Aim: To compare the pain relief, functional outcomes, and complication rates of AMR versus APM in individuals diagnosed with early-stage primary OA and degenerative meniscal tears.

Materials and Methods: This was a hospital-based observational comparative study conducted in the Department of Orthopaedics at SRM Medical College Hospital and Research Centre, Kattankulathur, Kanchipuram, Tamil Nadu, India, from June 2023 to May 2025. A total of 70 participants were included, with 35 patients assigned to the AMR group (Group A) and 35 patients to the APM group (Group B). Postoperative pain levels and functional recovery were assessed using the Lysholm Knee Score (LKS) and the Visual Analogue Scale (VAS). Statistical analysis was performed utilising IBM Statistical Package for Social Sciences (SPSS) version 21.0, considering a p-value of less than 0.05 as statistically significant.

Results: The mean age of participants was 51.41±4.9 years. Patients in the AMR group demonstrated significantly lower VAS scores (p-value=0.0001) and higher LKS scores (p-value=0.0001) compared to the APM group, indicating superior pain relief and functional recovery. Complication rates were also lower in the AMR group (p-value=0.046). However, surgical duration was comparable between both groups (p-value=0.372).

Conclusion: Meniscal preservation through AMR provides superior functional recovery and pain relief compared to APM, with a lower risk of postoperative complications. These findings reinforce the importance of meniscal preservation in optimising long-term joint health in patients with degenerative meniscal tears. Further, multicentre studies with extended follow-up are required to validate these results and assess the long-term progression of OA postmeniscal surgery.

Keywords: Arthroscopy, Knee, Meniscus injuries, Meniscectomy, Osteoarthritis

INTRODUCTION

Osteoarthritis (OA) of the knee is a significant global health concern, with its prevalence highlighting its widespread impact on the ageing population. Globally, knee OA affects approximately 16% of individuals aged 15 years and older, with the prevalence rising to 22.9% in those aged 40 and above [1]. By 2020, an estimated 654.1 million people aged 40 and older were living with knee OA worldwide [1]. This number is projected to increase further, with nearly 1 billion people expected to develop OA by 2050, largely due to factors such as ageing populations, obesity, and other lifestyle-related risks [2]. The meniscus, a C-shaped cartilage in the knee, plays a crucial role as a shock absorber between the femoral condyle and the tibial plateau. A meniscal tear is a common injury to this cartilage, often caused by twisting or rotating the knee forcefully [3]. Radiographic evidence indicates that meniscal pathologies are present in nearly all cases of knee OA (100%) and become significantly more frequent in patients with advanced stages of the disease [4]. If conservative treatments fail to provide sufficient symptom relief, surgical intervention becomes a viable option, with AMR and APM being the two primary approaches. A systematic review has demonstrated that meniscal repair is associated with significantly lower rates of OA progression (21.28%) compared to partial meniscectomy, which has a much higher rate of OA progression (51.42%) over long-term follow-ups [4,5].

Meniscal repair is designed to preserve the biomechanical integrity of the meniscus, thereby potentially delaying OA progression and improving long-term functional outcomes. Studies indicate that meniscal repair is associated with reduced rates of OA progression, meta-analysis reporting lower incidences of advanced OA and fewer total knee arthroplasties among patients undergoing repair over a six-year follow-up period [5,6]. Additionally, functional assessments using Lysholm and International Knee Documentation Committee (IKDC) scores consistently favour meniscal repair over meniscectomy, demonstrating improved knee function in repair groups [5,7].

In contrast, partial meniscectomy involves the removal of the damaged meniscal segment, which may provide immediate symptom relief but is linked to accelerated cartilage deterioration and an increased risk of OA progression. Research has shown that patients undergoing partial meniscectomy exhibit a significantly higher rate of OA progression (51.42%) compared to those who undergo meniscal repair (21.28%) [4]. Moreover, long-term observational studies emphasise the detrimental impact of meniscectomy on knee joint health and function, often leading to early-onset degenerative changes [8,9].

Despite the apparent advantages of meniscal preservation, certain challenges remain, including higher reoperation rates for meniscal repairs and patient-specific factors such as age, tear type, and knee

stability, all of which influence surgical decision-making [7,10]. While partial meniscectomy remains widely performed due to its relative simplicity and shorter operative time, growing evidence suggests that prioritising meniscal repair leads to better long-term joint health and functional outcomes [5,10].

Hence, the present study was conducted to compare pain relief and knee function following AMR and APM in patients with degenerative meniscal tears and early osteoarthritis. The study further aimed to determine whether meniscal preservation yields superior long-term outcomes, thereby contributing to improved treatment strategies and patient care.

MATERIALS AND METHODS

This was a hospital-based observational comparative study conducted in the Department of Orthopaedics at SRM Medical College Hospital and Research Centre, Kattankulathur, Kanchipuram, Tamil Nadu, India, from June 2023 to May 2025. Ethical clearance was obtained from the Institutional Ethics Committee of SRM Medical College Hospital and Research Centre (SRMIEC-ST0723-709). Written informed consent was obtained from all participants.

Inclusion and Exclusion criteria: This hospital-based observational comparative study included patients aged ≥40 years with radiologically confirmed grade I or II primary OA (Kellgren-Lawrence classification) and isolated degenerative meniscal tears confirmed by Magnetic Resonance Imaging (MRI), while those aged <40 years, with grade III or IV OA, associated ligament injuries such as ACL or PCL tears, previous knee surgeries, or secondary OA due to trauma, infection, or inflammatory arthritis were excluded.

Sample size calculation: The sample size was calculated using power analysis to ensure adequate statistical strength for identifying significant differences between the two treatment groups. The formula applied for sample size estimation is as follows:

$$n \geq \frac{[z_1 - \frac{\alpha}{2} + z_1 - \beta]^2 [\sigma_1^2 + \sigma_2^2]}{(\mu_1 - \mu_2)^2}$$

$$n = \frac{[1.96 + 0.84]^2 [30.6^2 + 18.1^2]}{(60.7 - 77.5)^2}$$

$$n = \frac{2.8^2 \times [936.36 + 327.61]}{282.24}$$

n=35

Thus, the final sample size per group was determined to be 35 patients, leading to a total sample size of N=70 patients (n1=35, n2=35).

Sample size was estimated based on previous literature [9] to detect significant differences in functional outcomes with a power of 80% and a confidence level of 95%.

Study Procedure

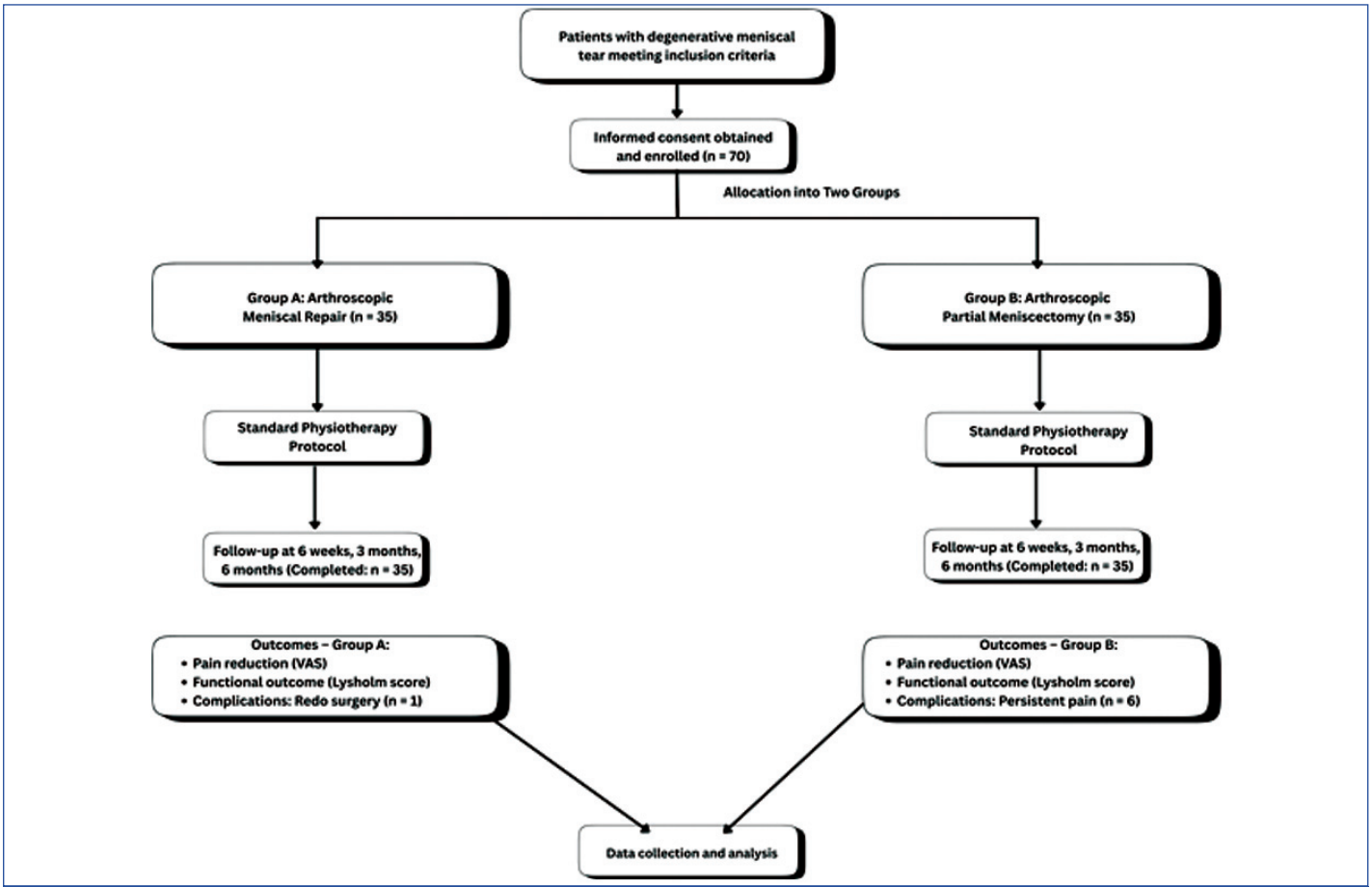
A total of 70 patients with degenerative meniscal tears and early-stage primary OA were included based on eligibility criteria. They were equally divided into two groups:

Group A: Arthroscopic Meniscal Repair (n=35)

Group B: Arthroscopic Partial Meniscectomy (n=35)

Out of the screened patients, 70 met the eligibility criteria and were enrolled, with random allocation into group A (AMA, n=35) and group B (APM, n=35). All surgeries were performed by experienced Orthopaedic surgeons using standard arthroscopic techniques, and postoperative care was standardised across both groups. Patients were evaluated preoperatively and at follow-up visits at 6 weeks, 3 months, and 6 months, with outcome measures including functional status assessed using the Lysholm Knee Scoring Scale (LKSS; 0-100), pain intensity using the Visual Analogue Scale (VAS; 0=no pain to 10=worst pain), and documentation of any postoperative complications [11,12].

The flowchart illustrates the patient enrollment process, inclusion/exclusion criteria, grouping, and follow-up assessments [Table/Fig-1].



[Table/Fig-1]: Flowchart representing study design and patient selection.

STATISTICAL ANALYSIS

Data were analysed using IBM SPSS version 21.0. Descriptive statistics were used to summarise demographic and baseline characteristics. Categorical variables were compared using the Chi-square test. An Independent Samples t-test was used for between-group comparisons, and a Paired Samples t-test was used to assess pre- and postoperative changes within each group. A p-value of <0.05 was considered statistically significant.

RESULTS

A significant number of the patients (52.9%) were aged between 51-60 years, while 44.3% were in the 41-50 years group. Only 2.9% were aged 61-70 years. The mean age was 51.41±4.9 years. Age-wise distribution and statistical comparison are detailed in [Table/Fig-2]. No statistically significant difference was observed between the two groups concerning laterality (p-value=0.632). In group A, the right knee was affected in 16 patients, whereas in group B, it was 18 patients. Conversely, the left knee was involved in 19 patients from group A and 17 patients from group B [Table/Fig-2].

Age group (in years)	Frequency Percentage (n) (%)	Laterality – Group A (Meniscal repair)	Laterality – Group B (Partial meniscectomy)
41-50	31 (44.3)	RIGHT: 16 LEFT: 19	RIGHT: 18 LEFT: 17
51-60	37 (52.9)	–	–
61-70	2 (2.9)	–	–
Mean age	51.41±4.9 years	–	–

[Table/Fig-2]: Age distribution of patients and laterality (N=70).

Male patients were more common in both groups, with no statistically significant difference between the two (p-value=0.197). Gender proportions are detailed in [Table/Fig-3].

Gender	Group A (n=35)	Group B (n=35)	Total (N=70)
Male	22	27	49
Female	13	8	21
p-value	0.197		

[Table/Fig-3]: Gender distribution of patients.

The posterior horn was the most commonly affected site. No statistical significance was observed between groups (p-value=0.859). Detailed data are presented in [Table/Fig-4].

Location of injury	Group A	Group B
Anterior horn	3	2
Posterior horn	12	10
Body	13	12
Body+ Anterior horn	2	3
Body+ Posterior horn	5	8
p-value	0.859	

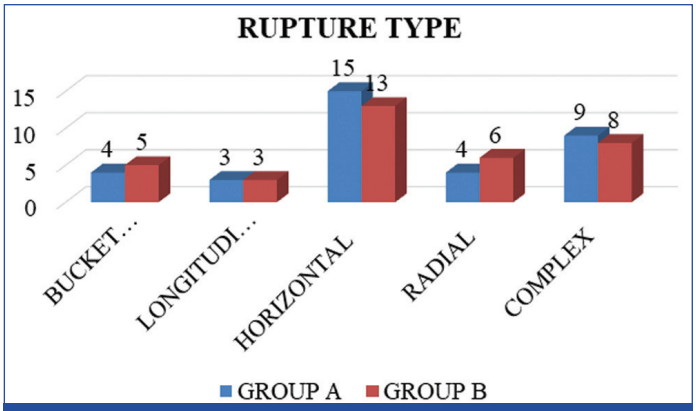
[Table/Fig-4]: Location of injury.

Horizontal ruptures were the most common, followed by complex tears. The comparison between the groups did not reveal a statistically significant difference (p-value=0.95). Additional details are presented in [Table/Fig-5].

The average surgical duration was comparable between the two groups, with no statistically significant difference (p-value=0.372) [Table/Fig-6].

Outcomes for pain relief: Postoperative pain levels were significantly lower in patients who underwent Arthroscopic Meniscal Repair (group A) compared to those who had Arthroscopic Partial Meniscectomy (group B) (p-value=0.00001). A summary of the results is provided in [Table/Fig-7].

Functional outcomes: Functional outcomes, as measured by the



[Table/Fig-5]: Rupture type of the meniscus.

Duration of surgery	Group A	Group B
Mean±SD	55.85±12.73	56.85±12.42
p-value	0.372	

Table/Fig-6]: Duration of surgery.

VAS Score	Group A	Group B
Mean±SD	3.42±0.59	4.68±0.622
p-value	0.0001	

[Table/Fig-7]: Visual Analogue Scale (VAS) score.

Lysholm Knee Score, were significantly better (p-value=0.0001) in group A compared to group B [Table/Fig-8].

Lysholm Knee Scoring Scale	Group A	Group B
Mean±SD	85.2±2.32	66.2±2.77
p-value	0.0001	

[Table/Fig-8]: Lysholm knee scoring scale.

The mean Lysholm Knee Scoring Scale (LKSS) at the final follow-up was significantly higher in group A, with a mean score of 85.2±2.32, compared to group B, which had a mean score of 66.2±2.77. The difference between the two groups was statistically highly significant (p-value=0.0001), indicating superior functional outcomes in patients who underwent arthroscopic meniscal repair [Table/Fig-9].

Osteoarthritis Grade	Group A (n=35)	Group B (n=35)	Total (N=70)
Grade I	12	10	22
Grade II	23	25	48

[Table/Fig-9]: Comparison of Lysholm Knee Scores.

Among the 70 patients, 22 had grade I osteoarthritis (Group A: 12; Group B: 10), and 48 had grade II osteoarthritis (Group A: 23; Group B: 25). Grade II cases were more common overall. Both surgical groups had a higher proportion of grade II patients, consistent with early-stage degenerative changes.

While only one patient in group A required redo surgery, six patients in group B reported persistent pain on follow-up. This difference was statistically significant (p-value=0.046) [Table/Fig-10].

Parameters	Group A (Meniscal Repair, n=35)	Group B (Meniscectomy, n=35)
Total patients with complications	1 (2.86%)	6 (17.14%)
Type of complication	Redo surgery (n=1)	Persistent pain (n=6)
Patients without complications	34 (97.14%)	29 (82.86%)
Mean VAS Score (without complications)	2.1±0.6	3.2±0.9
Mean VAS Score (with complications)	5.0	6.3±1.1
Mean LKSS (without omplications)	88.5±4.3	79.2±5.8
Mean LKSS (with complications)	72.0	65.7±6.4

[Table/Fig-10]: Comparison of complications on follow-up.N=70

Postoperative outcomes: Out of 70 patients, complications were observed in 1 patient (2.86%) in group A and 6 patients (17.14%) in group B. Group B patients with complications reported persistent pain, while group A had one redo surgery. Complicated cases showed higher VAS scores and lower LKSS, indicating poorer functional outcomes.

No subgroup or sensitivity analyses were performed. Future studies should consider analysing subgroups based on age, gender, and tear morphology to explore potential variations in surgical outcomes.

DISCUSSION

The present study was conducted to evaluate and compare pain relief and functional outcomes between AMR and APM in patients with early primary osteoarthritis and degenerative meniscal tears. The overall findings demonstrate that meniscal repair offers superior benefits in terms of both pain reduction and functional recovery, reinforcing the importance of meniscal preservation in optimising patient outcomes and delaying osteoarthritic progression.

Postoperative pain relief, as assessed using the VAS, was significantly greater in the repair group compared with the meniscectomy group. These results are consistent with previous studies highlighting the protective role of the meniscus in joint mechanics and its contribution to pain attenuation following surgery [13,14]. A plausible explanation is that preserving meniscal tissue reduces direct cartilage loading and maintains its natural shock absorption function, thereby minimising postoperative discomfort and inflammation.

Functional outcomes, measured using the LKSS, were also significantly better in the repair group. This finding suggests that meniscal repair contributes to improved joint stability and restoration of normal biomechanics, which is in agreement with existing literature [13-15]. The superior results observed in the repair group can be attributed to the preservation of meniscal structure, thereby maintaining proprioception and effective load distribution within the knee.

Operative time was similar in both groups, suggesting that surgical duration should not be a determining factor when selecting between repair and meniscectomy [16]. However, complication rates were lower among patients undergoing meniscal repair. In contrast, those who underwent partial meniscectomy reported more frequent residual knee pain and required additional interventions, which is consistent with earlier reports emphasising the long-term adverse effects of meniscal loss [13,14,16]. These complications are likely due to altered biomechanics and increased stress on the articular cartilage following tissue excision.

Despite these findings, several limitations must be acknowledged. The relatively short follow-up restricts evaluation of long-term osteoarthritis progression and sustained functional outcomes. Longer-term studies would provide a more comprehensive understanding of surgical efficacy. Additionally, factors such as body mass index, activity level, co-morbidities, tear morphology, and patient age were not controlled, potentially influencing the results. Being a single-centre study, the findings may also be influenced by variations in surgical expertise and rehabilitation protocols. Moreover, subgroup analysis based on tear characteristics or patient demographics was not performed, which limits deeper insights into differential outcomes.

Overall, the results align with current literature that advocates for meniscal preservation over excision. Meniscectomy has been associated with accelerated cartilage degeneration, increased osteoarthritis risk, and impaired joint stability due to altered biomechanics [13,17,18]. In contrast, meniscal repair preserves joint congruity and biomechanics, thereby reducing the risk of degenerative changes and delaying osteoarthritis progression [15]. Nevertheless, meniscal repair may not be suitable in all cases, as decision-making must consider factors such as chronicity of the tear, vascular supply, tear configuration, and associated ligament injuries [14,17].

Although these results corroborate findings from earlier studies on similar patient populations, the single-centre design of this study limits external validity. Future research should focus on multicenter trials with larger and more diverse populations to enhance generalisability [15]. Additionally, long-term follow-up is necessary to assess the progression of osteoarthritis and the durability of functional recovery with both techniques [14,19]. Advancements in biologic augmentation and tissue engineering also hold promise for improving healing outcomes after meniscal repair by enhancing tissue regeneration and repair capacity [17].

Limitation(s)

However, the study has certain limitations. The short-term follow-up does not capture long-term osteoarthritis progression or the durability of functional benefits. Important variables such as body mass index, activity level, comorbidities, tear morphology, and patient age were not analysed, which may have influenced outcomes. Being a single-centre study, the findings may not be generalisable to broader populations due to potential differences in surgical expertise and rehabilitation practices. Furthermore, subgroup analyses based on tear pattern or patient characteristics were not performed, limiting the ability to identify which patients might benefit most from each procedure.

CONCLUSION(S)

By preserving meniscal tissue, repair maintains joint biomechanics, stability, and load distribution, which are critical in protecting articular cartilage and delaying osteoarthritic progression. The present study findings reinforce the role of meniscal preservation as a preferred strategy in eligible patients, offering not only superior short-term outcomes but also the potential for long-term joint health.

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