

Arthroscopic Meniscal Repair Using Outside-in Technique

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Abstract

Background: The menisci are crucial for knee joint health and longevity, but injuries to them are common, accounting for up to seventy-five percent of internal knee complications.

Aim and objectives: To assess the outcome of Arthroscopic meniscal repair using the outside-in technique and to evaluate its impact on meniscal healing at 3-6 months of follow-up.

Patients and methods: This prospective research involves twenty patients with meniscal tear surgery in AL-Azhar University Hospitals (Al-Hussein and Bab Alshaaria Hospitals) and Nasser Institute for research and treatment between May 2023 and May 2024.

Results: Post-operative 3 months and 6 months Lysholm scores and Post-operative 6 months IKDC scores showed significant increases compared to preoperative scores, p -value < 0.001. There was a statistically significant increase in preoperative Lysholm score (p -value = 0.002), 3 months (p -value = 0.013), and 6 months (p -value = 0.023) post-operative Lysholm score in patients with 10-15 mm tears when compared with patients with 16-20 mm tears. There was a statistically significant (p -value = 0.016) increase in preoperative Lysholm score in acute patients compared with chronic patients. Also, there was a statistically significant (p -value < 0.001) increase in 3 months and 6 months post-operative Lysholm score in Acute patients when compared with chronic patients.

Conclusion: Meniscal repair improves outcomes for recent vascular longitudinal tears, with factors like tear length and pattern influencing outcomes. The outside-in technique with vertical sutures is minimally invasive, simple, and cost-effective.

Keywords: Outside-in Technique; Arthroscopic Meniscal Repair; outcome

1. Introduction

The menisci are crucial for knee joint health and longevity, but injuries to them are common, accounting for up to seventy-five percent of internal knee complications.¹

Historically, meniscal tears were often treated with excision, but evidence linking meniscectomy to increased osteoarthritis has led to the development of repair techniques.²

Partial and total meniscectomies have been shown to lead to defective load distribution, decreased shock absorption, and articular cartilage degeneration, leading to an increased risk of developing osteoarthritis.³ they lead to a significant increase in contact pressure in the knee condyles, particularly problematic for

athletes. Repair surgeries have high success rates and allow athletes to return to pre-injury levels of activity.⁴ Repairs of meniscal tears restore normal condyle contact pressures.⁵

Meniscal repair techniques include open or arthroscopic techniques, which include outside-in, all-inside, and inside-out repair techniques.⁶

The reparability of the meniscus is determined by its vascular supply. The experimental results have shown that the blood supply to the outside part of the meniscus can generate a reparative response like what is seen in other types of connective tissues.⁷

This study aimed to assess the outcome of Arthroscopic meniscal repair using outside-in technique and to evaluate its impact on meniscal healing at 3-6 months follow-up.

Accepted 15 April 2025.

Available online 30 June 2025

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<https://doi.org/10.21608/aimj.2025.446618>

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2. Patients and methods

This prospective research involves twenty cases with meniscal tear surgery in AL-Azhar University Hospitals (Al-Hussein and Bab Alshaaria Hospitals) and Nasser Institute for research and treatment between May 2023 and May 2024.

Inclusion criteria: Males and females, skeletal maturity, age between 20 and 40 years old, isolated Meniscal tears and Medial and lateral meniscal tears.

Exclusion criteria: Skeletal immaturity, Patients with poor general condition, Cases with any degree of osteoarthritis or mal-alignment, and cases with meniscal tears associated with ACL or PCL.

Methods

Preoperative Evaluation

History: Preoperative presenting symptoms: Pain, limping, limited movement of the affected knee were almost constant findings in our cases, with variable degree with some patients complaining about locking of the affected knee.

Preoperative Scoring System: The English questionnaire included personal data, injury and operation information, and subjective and knee examination questions from the Lysholm Knee Scoring Scale⁸ and the International Knee Documentation Committee for evaluating all patients on the first visit.⁹

Operative Procedures: Palpation of the basic landmarks, including the patella, patellar tendon, and tibial and femoral condyles, was done. **Portals:** The anterolateral portal was taken 0.5 centimeters lateral to the patellar tendon, then the trocar was introduced. The knee was flushed with irrigation fluid, and the blunt was replaced with a 4 mm 30-degree lens. The inflow solution was connected to one port, and a suction drain was connected to the other. **Diagnostic Arthroscopy:** The knee was surveyed for pathology in the suprapatellar, medial gutter, lateral gutter, and patellofemoral articulation. The anteromedial portal is achieved under vision. The medial meniscus was inspected, with the concealed area best viewed while flexing the knee 15°-20° with valgus external rotation stress. The posterior horn of the medial meniscus is viewed through the intercondylar notch, and the lateral meniscus is viewed while the leg is in the figure of four position. **Operative Arthroscopy:** The procedure involves defining the tear length and rim width and preparing it by removing unhealthy tissue and rasping it.

If a bucket-handle tear was dislocated, reduction was performed with a probe. A wide-pore 16G cannula was inserted through the capsule and peripheral portion of the meniscus, and counterforces were applied. A proline suture was used to relay the number 1 PDS suture through the anteromedial portal. A second cannula is inserted and preloaded with proline suture, and a sliding arthroscopic knot is applied to create a vertical suture.

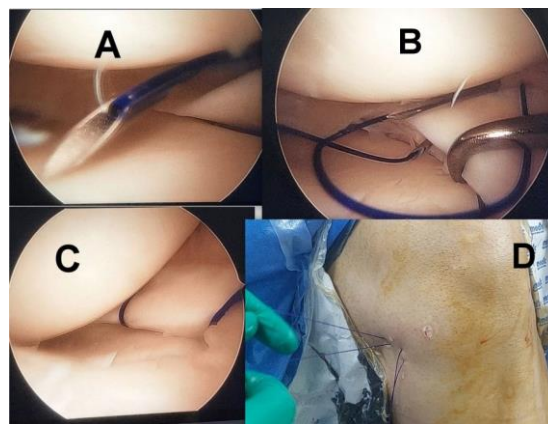


Figure 1. Arthroscopic view of the knee: (A) 2nd cannula introduced. (B) The two cannulas loaded with proline sutures used to relay the No. 1 PDS suture. (C) 2 vertical sutures using Number 1 PDS suture. (D) The suture is tied over the capsule to create a vertical meniscal suture.

Post-Operative care: After surgery, patients were given a simple dressing, compression, and monitoring of peripheral circulation. They were then discharged the next day, and gentle ROM exercises were initiated to increase knee strength. After 12-14 days, stitches were removed and any warning signs were checked such as persistent pain, swelling, or edema.

Follow-up and rehabilitation program^{10,11}: Post-operative physical therapy for meniscus repair can be separated into early and late rehabilitation phases. The immediate phase begins with a hinged knee brace, followed by partial weight-bearing. The early rehabilitation phase involves full weight-bearing and achieving a full active range of motion of the knee. The late rehabilitation phase involves return to sport or occupation, functional progression, such as stationary biking and stair climbing, and return to activity. Patients were assessed postoperatively at 3 and 6 months by clinical evaluation using the Lysholm score, and were assessed postoperatively at 6 months by subjective knee assessment using the knee investigation form of the IKDC.

3. Results

Table 1. description of demographic data in all studied cases.

STUDIED CASES (N = 20)			
SEX	Male	18	90%
	Female	2	10%
AGE (YEARS)	Mean $\pm$ SD	29.7 $\pm$ 5.4	
	Min - Max	20 - 38	
AGE CATEGORIES	Young age (20-30)	9	45%
	Old age (30-40)	11	55%
OCCUPATION	Accountant	2	10%
	Carpenter	1	5%
	Clerk	2	10%
	Doctor	1	5%
	Engineer	1	5%
	Farmer	1	5%
	Housewife	2	10%
	Lawyer	2	10%
	Nurse	1	5%
	Student	3	15%
	Teacher	2	10%
	Worker	2	10%

Regarding age, the mean age of all the cases analyzed was 29.7 ± 5.4 years, with a minimum age of twenty years old and a maximum age of thirty-eight. The study included nine cases at the young age group, accounting for forty-five percent of the total, and eleven cases in the old age group, accounting for fifty-five percent. In terms of gender, the study included eighteen men (ninety percent) and two women (ten percent) among the cases examined. The occupation of the cases in study was presented in the table. (Table 1)

Table 2. correlation between Lysholm score and IKDC score throughout the study and between Lysholm score and time from injury to surgery and tear length of the studied patients.

		PRE-OP	3 MONTHS POST-OP	6 MONTHS POST-OP
LYSHOLM SCORE (THROUGHOUT THE STUDY)	All Patients (N=20)	42.1 $\pm$ 8.5 (33-61)	66.7 $\pm$ 13.7 (42-89)	84.3 $\pm$ 14.9 (54-97)
	Friedman test P-value		40 p < 0.001 (HS)	
IKDC SCORE (THROUGHOUT THE STUDY)	All Patients (N=20)	42.1 $\pm$ 7.8 (30-62)	—	82.2 $\pm$ 15.9 (50-95)
	Paired t-test P-value		t = 17.02 p < 0.001 (HS)	
LYSHOLM BY TEAR LENGTH	10-15 mm (n=7)	49.6 $\pm$ 6.0 (45-61)	77.1 $\pm$ 6.0 (71-89)	95.0 $\pm$ 1.9 (91-97)
	16-20 mm (n=8)	40.8 $\pm$ 7.8 (33-54)	64.6 $\pm$ 12.2 (45-74)	82.3 $\pm$ 13.8 (59-91)
	20-25 mm (n=5)	34.0 $\pm$ 1.2 (33-36)	55.4 $\pm$ 14.9 (42-74)	72.6 $\pm$ 18.6 (54-95)
	Stat. test P-value	F = 9.5 p = 0.002 (S)	F = 5.6 p = 0.013 (S)	F = 4.7 p = 0.023 (S)
LYSHOLM BY TIME FROM INJURY TO SURGERY	Acute ($\leq$ 8w, n=12)	45.8 $\pm$ 8.4 (33-61)	74.7 $\pm$ 5.5 (69-89)	93.3 $\pm$ 2.9 (89-97)
	Chronic (>8w, n=8)	36.8 $\pm$ 5.5 (33-50)	54.8 $\pm$ 13.9 (42-74)	70.8 $\pm$ 15.6 (54-90)
	Independent t-test P-value	T = 2.64 p = 0.016 (S)	T = 4.5 p < 0.001 (HS)	T = 4.9 p < 0.001 (HS)

HS: p-value < 0.001 is considered highly

significant. t: paired sample T test. T: independent sample T test F: F value of ANOVA test. NS: p-value > 0.05 is considered non-significant S: p-value < 0.05 is considered significant.

There was high statistically significant (p-value < 0.001) increased 3 months post-operative Lysholm score and 6 months following surgery Lysholm score when compared with pre-surgery Lysholm score.

There was high statistically significant (p-value < 0.001) increased 6 months following surgery international knee documentation committee score when compared with pre-operative IKDC score.

There was statistically significant increased pre-operative Lysholm score (p-value = 0.002), 3 months (p-value = 0.013) and 6 months (p-value = 0.023) post-operative Lysholm score in patients of 10-15 mm tear when compared with patients of 16-20 mm tear.

There was statistically significant (p-value = 0.016) increased preoperative Lysholm score in Acute patients (time from injury to surgery $\leq$ 8 weeks) when compared with chronic patients (time from injury to surgery > 8 weeks). Also, there was high statistically significant (p-value < 0.001) increased 3 months and 6 months post-operative Lysholm score in Acute patients when compared with chronic patients. (Table 2)

The average Lysholm score before surgery was 42.1, with a range of 33 to 61 and a standard deviation of 8.5. The IKDC subjective evaluation also had an average score of 42.1, with a range of thirty to sixty-two and a standard deviation of 7.8. It is important to observe that all cases had low scores. The mean Lysholm score three months after the operation was 66.7, with a range of forty-two to eighty-nine and a standard deviation of 13.7. The mean Lysholm score six months after the operation was 84.3, with a range of fifty-four to 97 and a standard deviation of 14.9. The average IKDC subjective evaluation score at six months post-operation was 82.2, with a range of fifty to 95 and a standard deviation of 15.9. Out of the total number of cases, 7 (35%) had an outstanding score, 8 (40%) had a good score, and 5 (25%) had a poor score.

Table 3. correlation between Lysholm score

and IKDC score and affected miscues of the studied patients.

		PRE-OP LYSHOLM	3 MONTHS LYSHOLM	6 MONTHS LYSHOLM	PRE-OP IKDC	6 MONTHS IKDC
AFFECTED MENISCUS	Medial (n=14)	42.6 ± 8.9 (33–61)	68.2 ± 13.2 (45– 89)	86.0 ± 13.9 (59– 97)	43.2 ± 7.8 (30–62)	84.0 ± 15.2 (50– 95)
	Lateral (n=4)	39.8 ± 6.2 (33–45)	64.8 ± 13.2 (45– 72)	83.0 ± 14.7 (61– 91)	39.5 ± 6.7 (30–45)	81.3 ± 14.2 (60– 89)
	Lat.discoid (n=2)	44.0 ± 14.1 (34– 54)	60.0 ± 25.5 (42– 78)	75.0 ± 29.7 (54– 96)	40 ± 14.1 (30–50)	72.0 ± 31.1 (50– 94)
	Stat. test	F = 0.203	F = 0.388	F = 0.465	F=0.4	F = 0.476
	P-value	p = 0.818 (NS)	p = 0.718 (NS)	p = 0.638 (NS)	P=0.677 (NS)	p = 0.629 (NS)

F: F value of ANOVA test. NS: p-value > 0.05 is considered non-significant.

The mean post-operative international knee documentation committee subjective score for (medial meniscus tear group) was 84 ± 15.2 ; while The mean post-operative international knee documentation committee subjective score was 81.3 ± 14.2 . for lateral meniscus tear cases.

There was statistically insignificant correlation (p-value = 0.677) between pre-operative IKDC score and affected meniscus and between 6 months post-operative IKDC score and affected meniscus (P-value = 0.629).

The mean post-operative Lysholm score of 3 months follow up for the (medial meniscus tear group) was 68.2 ± 13.2 and The mean post-operative Lysholm score of 6 months follow up for the (medial meniscus tear group) was 86 ± 13.9 . while in (lateral meniscus tear cases) the mean post-operative Lysholm score of 3 months follow up was 64.8 ± 13.2 and The mean post-operative Lysholm score of 6 months follow up was 83 ± 14.7 .

There was statistically insignificant correlation (p-value = 0.818) between pre-operative Lysholm score and affected meniscus and between 3 months post-operative Lysholm score and affected meniscus (P-value = 0.718) and between 6 months post-operative Lysholm score and affected meniscus (P-value = 0.638). (Table 3)

4. Discussion

The Lysholm score remains one of the most used evaluation tools for knee evaluation. The International Knee Documentation Committee score also demonstrated acceptable psychometric parameters, supporting its suitability as an assessment tool for meniscal injuries.¹²

This research examined the published findings of Plasschaert et al. regarding their use of the mulberry knot technique for outside-in meniscus repair in forty-one cases. Their findings indicated a rate of recovery of seventy-four percent

following an average of 3.5 years of clinical follow-up. The series documented a 7.3 percent infection rate (three cases) that was successfully treated with antibiotic treatment, as well as a fourteen percent prevalence of transient saphenous nerve damage (six cases).¹³ Our investigation observed an acute infection in one case, accounting for five percent of the total. The infection was successfully treated with antibiotic therapy and debridement.

Buchalter et al. conducted a retrospective case series study involving thirty-three cases that received thirty-three meniscal procedures.¹⁴ The subsequent subjective IKDC score was 86.3 percent. There were no statistically significant correlations found between failure & tear complexity, tear age, patient age, tear vascularity, patient sex, laterality, or isolated meniscal repair. This research found statistically significant correlations among the findings, tear pattern, and length.

The findings of this investigation were lower than the published findings of Abdelkafy et al., who reported their long-term monitoring of outside-in meniscus repairs in 41 patients. After an average follow-up period of 11.71 years, thirty-six cases (88%) had clinical success, whereas five cases (12%) were classified as failures, meaning they needed to undergo a meniscectomy following having meniscus repair.¹⁵ Furthermore, the results obtained were lower than those published by Sobhy et al., who reported a clinical satisfaction rate of eighty-eight percent in a cohort of forty-one cases, with a mean follow-up duration of 2.7 years. The patients in our group also had a significant improvement in the median Lysholm score, which increased from thirty-four to eighty-eight. Similarly, the median IKDC subjective ratings showed a significant improvement, increasing from twenty-five to eighty-eight. In this study, the success rates of meniscus repair range from fifty percent to ninety-one percent. This is due to the limitations of our study.¹⁶

The cases under investigation were cases aged between 20 and 38 years, with a mean age of 29.7 ± 5.4 . Age didn't have a statistically significant effect on the failure rate of repairs. Barber and Herbert investigated the age of cases with symptomatic torn menisci during their clinical evaluation. 72% of their cases were aged 45 or younger.¹⁷ Hence, a significant proportion of the cases were at an age where restoration was feasible. However, Becker et al. discovered that in elderly patients, most meniscal tears were degenerative in origin and therefore not suitable for repair.⁷

Regarding the gender distribution of patients in our research, the majority (ninety percent) were

men, while the remaining ten percent were females. In a separate investigation carried out by Barrett et al. on thirty-seven percent of cases, 70.3% (n=26) of the cases were males, while only 29.7% (n=11) were females. No association between sex and the clinical result was mentioned.¹⁸

Regarding the injury repair interval, the mean time from trauma to surgery of all studied cases was 7.45 ± 3.8 weeks, with a minimum time from trauma to surgery of 3 weeks and a maximum time from trauma to surgery of 15 weeks. All five postoperative clinically symptomatic cases were chronic and came for repair more than 8 weeks post-injury. The mean post-operative Lysholm score of 3 months follow up for the (acute meniscal tear group) was 74.7 ± 5.5 and The mean post-operative Lysholm score of 6 months follow up for the (acute meniscal tear group) was 93.3 ± 2.9 and The mean post-operative international knee documentation committee subjective score for the (acute meniscal tear group) was 91.5 ± 3.3 , while in (chronic meniscal tear) the mean post-operative Lysholm score of 3 months follow up was 54.8 ± 13.9 and The mean post-operative Lysholm score of 6 months follow up was 70.8 ± 15.6 and The mean post-operative international knee documentation committee subjective score was 68.4 ± 17.6 . This signifies that there was a significant statistical difference in the post-operative score of both groups. In a study conducted by Barrett et al.¹⁸ on thirty-seven cases, it was discovered that cases with older tears had a higher rate of failure compared to those with acute tears. In contrast, Buchalter et al. reported no significant distinctions in the clinical outcomes among acute and chronic injuries.¹⁴

Regarding the meniscal side, our study signifies that there was no significant statistical variation in the post-operative score of patients with medial and patients with lateral meniscal tears. Buchalter et al. showed that no difference in functional results was found according to the repair of MM or LM.¹⁴ But Majeed et al. demonstrated that the failure rate was lower in cases of lateral meniscal repair.¹⁹

limitations of the study

There are some limitations in our study including limited number of patients in our investigation, the high prevalence of long-term meniscal tears, the intricate nature of the tears, and the relatively brief duration of the follow-up period.

4. Conclusion

Meniscal repair improves outcomes for recent vascular longitudinal tears, with factors like tear length and pattern influencing outcomes. The

outside-in technique with vertical sutures is minimally invasive, simple, and cost-effective.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

References

1. Steenbrugge, F. (2008). Long-term outcome of meniscus and cruciate ligament stabilization in the injured knee (Doctoral dissertation, Ghent University).
2. Yoon KH, Park KH. Meniscal repair. *Knee Surg Relat Res.* 2014;26(2):68-76. doi:10.5792/ksrr.2014.26.2.68
3. Hurmuz, M., Ionac, M., Hoge, B., Miu, C. A., & Tatu, F. (2024). Osteoarthritis Development Following Meniscectomy vs. Meniscal Repair for Posterior Medial Meniscus Injuries: A Systematic Review. *Medicina*, 60(4), 569.
4. Dave LY, Caborn DN. Outside-in meniscus repair: the last 25 years. *Sports Med Arthrosc Rev.* 2012;20(2):77-85.
5. Prince MR, Esquivel AO, Andre AM, Goitz HT. Anterior horn lateral meniscus tear, repair, and meniscectomy. *J Knee Surg.* 2014;27(3):229-234.
6. Schweizer C, Hanreich C, Tscholl PM, Blatter S, Windhager R, Waldstein W. Meniscal Repair Outcome in 3829 Patients With a Minimum Follow-up From 2 Years Up to 5 Years: A Meta-analysis on the Overall Failure Rate and Factors Influencing Failure. *The American Journal of Sports Medicine.* 2023;52(3):822-831.
7. Becker R, Stärke C, Heymann M, Nebelung W. Biomechanical properties under cyclic loading of seven meniscus repair techniques. *Clin Orthop Relat Res.* 2002;400:236-245.
8. Barber-Westin SD, Noyes FR. Rating of athletic and daily functional activities: knee-specific scales and global outcome instruments. *Noyes' Knee Disorders: Surgery, Rehabilitation, Clinical Outcomes.* 2017 Jan 1:1211-21.
9. Łakomy O, Trybulski R, Gońca A, Ćebrowska A. Knee Dislocation: Comprehensive Rehabilitation Program after Two-Stage Ligament Reconstruction. In *Sports, Health and Exercise Medicine* 2019 Oct 10. IntechOpen. Doi: 10.5772/intechopen.89649
10. Noyes FR, Heckmann TP, Barber-Westin SD. Meniscus repair and transplantation: a comprehensive update. *J Orthop Sports Phys Ther.* 2012;42(3):274-290.
11. Tucciarone A, Godente L, Fabbrini R, Garro L, Salate Santone F, Chillemi C. Meniscal tear repaired with Fast-Fix sutures: clinical results in stable versus ACL-deficient knees. *Arch Orthop Trauma Surg.* 2012;132(3):349-356.
12. Crawford K, Briggs KK, Rodkey WG, Steadman JR. Reliability, validity, and responsiveness of the IKDC score for meniscus injuries of the knee. *Arthroscopy.* 2007;23(8):839-844.
13. Plasschaert F, Vandekerckhove B, Verdonk R. A known technique for meniscal repair in common practice. *Arthroscopy.* 1998;14(8):863-868.
14. Buchalter DP, Karzel R, Friedman M, Getelman M. Evaluation of all-inside arthroscopic meniscal repair using the Fast-Fix system (SS-35). *Arthroscopy.* 2006 Jun 1;22(6):e18-9.
15. Abdelkafy A, Aigner N, Zada M, Elghoul Y, Abdelsadek H, Landsiedl F. Two to nineteen years follow-up of arthroscopic meniscal repair using the outside-in technique: a retrospective study. *Arch Orthop Trauma Surg.* 2007;127(4):245-252.
16. Sobhy MH, AbouElsoud MM, Kamel EM, Desouki AM. Neurovascular safety and clinical outcome of outside-in repair of tears of the posterior horn of the medial meniscus. *Arthroscopy.* 2010;26(12):1648-1654.
17. Barber FA, Herbert MA. Meniscal repair devices. *Arthroscopy.* 2000;16(6):613-618.
18. Barrett GR, Richardson K, Ruff CG, Jones A. The effect of suture type on meniscus repair. A clinical analysis. *Am J Knee Surg.* 1997;10(1):2-9.
19. Majeed H, Karuppiah S, Sigamoney KV, Geutjens G, Straw RG. All-inside meniscal repair surgery: factors affecting the outcome. *J Orthop Traumatol.* 2015;16(3):245-249.