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**Case Series**

# Meniscal preservation beyond 40 – outcomes of arthroscopic repair of chronic bucket-handle tears

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## ABSTRACT

This case series evaluated the outcomes of arthroscopic repair in five patients aged over 40 years with chronic medial bucket-handle meniscal tears, with a mean symptom duration of nine months. All patients demonstrated intraoperative adhesions (60% classified as major) along with grade 1 to 2 chondral changes. Despite attempted repair, a 100% failure rate was observed within 2 to 5 months, necessitating subsequent meniscectomy in all cases. Functional outcomes, as measured by the IKDC score, showed only modest improvement following repair (38.2%-54.0%), but improved substantially after meniscectomy (77.5% at one year; mean gain of 39.5%). Similarly, pain scores (VAS) demonstrated significant reduction only after meniscectomy (6.6-2.4). These findings suggest that in middle-aged patients with delayed presentation of chronic bucket-handle tears, the likelihood of repair failure is high, and primary or early meniscectomy may represent a more pragmatic treatment strategy.

**Keywords:** Bucket-handle meniscal tear, Meniscal repair, Meniscectomy, Chronic meniscal tear, Middle-aged patients

## INTRODUCTION

Bucket-handle meniscal tears represent unstable longitudinal lesions and account for approximately 10% of all meniscal injuries, occurring most commonly in younger and physically active individuals.[1] Although partial meniscectomy may provide short-term symptomatic relief, it necessitates the removal of substantial meniscal tissue and has been consistently associated with increased tibio-femoral contact pressures and accelerated compartmental degeneration. Consequently, contemporary treatment paradigms strongly favor meniscal preservation whenever technically and biologically feasible.[2] Several clinical series have demonstrated that even chronic bucket-handle tears can be successfully repaired with acceptable failure rates and favorable functional outcomes, particularly in younger patient populations. However, these studies predominantly exclude middle-aged individuals, especially those presenting after a delayed interval and with early degenerative changes.

As a result, the reparability and durability of chronic bucket-handle meniscal tears in this demographic remain poorly defined.[3] The present study reports a series of middle-aged patients with chronically displaced medial bucket-handle meniscal tears who presented after a prolonged delay and underwent initial arthroscopic reduction, adhesiolysis and meniscal repair. The primary objective was to assess the clinical and functional outcomes of this treatment strategy, including the

incidence and timing of subsequent meniscectomy and to contextualize these findings within the existing literature on chronic bucket-handle meniscal repair.

## CASE SERIES

### *Patients and methods*

This case series included five consecutive patients (4 males, 1 female) with a mean age of 42.6 years (range, 40 to 46 years) who underwent arthroscopic repair for chronic displaced medial bucket-handle meniscal tears between 2021 and 2025. The mean duration of symptoms was 9 months (range, 8-10 months). Inclusion criteria comprised age >40 years, MRI-confirmed displaced bucket-handle tears and failure of conservative management for at least 8 months. Patients with prior knee surgery, inflammatory arthritis or advanced osteoarthritis were excluded. The right knee was involved in four cases (80%). All patients presented with pain (100%), while mechanical locking symptoms were reported in three patients (60%).

### *Surgical technique*

All procedures were performed arthroscopically using standard anterolateral and anteromedial portals, with accessory portals utilized as required. A systematic diagnostic arthroscopy was undertaken in all cases to assess ligamentous integrity and chondral status. This was followed by capsulomeniscal and intercondylar adhesiolysis, reduction of the displaced meniscal fragment and repair using conventional suture techniques (inside-out or outside-in). No traction-first techniques or anterior interval release procedures were employed. Chondral lesions were graded intraoperatively. Concomitant anterior cruciate ligament (ACL) pathology, when present, was managed at the surgeon's discretion.

### *Rehabilitation protocol*

Postoperatively, patients were maintained in an extension brace for 6 weeks with restricted range of motion (00 to 900) and partial weight-bearing. Gradual progression to full weight-bearing and strengthening exercises was subsequently initiated. Failure was defined as recurrence of pain, effusion or mechanical symptoms necessitating revision surgery (meniscectomy). Outcomes were assessed using the International Knee Documentation Committee (IKDC) subjective score and Visual Analog Scale (VAS) for pain at three time points: preoperatively, following repair and at one year following meniscectomy.

### *Findings and outcomes*

Arthroscopic evaluation revealed minor adhesions in two patients (40%) and major adhesions in three patients (60%). All patients demonstrated grade 1 to 2 chondral changes. The ACL was intact in four patients (80%) and partially torn in one patient (20%).

All meniscal repairs failed (100%), requiring subsequent meniscectomy at a mean of 5 months (range, 2-5 months). Functional outcomes showed a modest improvement in IKDC scores following repair (from 38.2% preoperatively to 54.0%), with substantial improvement after meniscectomy (77.5% at one year). Pain scores (VAS) demonstrated minimal change following repair (6.6-6.2), but significantly improved after meniscectomy (2.4 at one year). All the data is summarized in Table 1.

**Table 1: Comprehensive case series data (n=5).**

| Parameters | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | N (%)/mean±SD |
|---|---|---|---|---|---|---|---|
| **Age (years)** | | 42 | 40 | 46 | 43 | 42 | 42.6±2.3 |
| **Gender** | | Male | Male | Female | Male | Male | Male 4 (80%) |
| **Side** | | Right | Right | Right | Left | Right | Right 4 (80%) |
| **Symptoms** | Pain | Present | Present | Present | Present | Present | 5 (100%) |
| | Swelling | Present | Present | Absent | Present | Present | 4 (80%) |
| | Locking | Present | Absent | Present | Present | Absent | 3 (60%) |
| | Joint line tenderness | Absent | Absent | Present | Absent | Absent | 1 (20%) |
| **McMurray test (medial meniscus-mm; Lateral meniscus-lm)** | | Positive mm | Positive mm | Positive lm | Positive mm | Positive mm | Mm-4 (80%) Lm-1 (20%) |
| **Chronicity of tear (months)** | | 8 | 8 | 10 | 9 | 10 | 9±0.9 |
| **MRI findings** | Meniscus status (medial meniscus-mm; Lateral meniscus-lm) | Mm tear | Mm tear | Lm tear | Mm tear | Mm tear | Mm-4 (80%) Lm-1 (20%) |
| | Adhesions | Minor | Major | Major | Minor | Major | Major-3 (60%) Minor-2 (40%) |

Continued.

| Parameters | | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | N (%)/mean±SD |
|---|---|---|---|---|---|---|---|
| | Cruciate ligament status | ACL and PCL normal | ACL and PCL normal | Partial tear of ACL, PCL normal | ACL and PCL normal | ACL and PCL normal | ACL intact-4 (80%), Partial ACL tear-1 (20%), PCL intact-5 (100%) |
| | Cartilage wear | Grade 1 | Grade 1 | Grade 2 | Grade 1 | Grade 2 | Grade 1-3 (60%) Grade 2-2 (40%) |
| **Treatment** | Meniscal repair done with adhesiolysis | Yes | Yes | Yes | Yes | Yes | Done-5 (100%) |
| | Recurrence of symptoms (duration) | Yes, 2 months post-op | Yes, 3 months post-op | Yes, 2 months post-op | Yes, 4 months post-op | Yes, 5 months post-op | Repairs failed-5 (100%) |
| | Meniscectomy performed (months after primary repair) | 4 | 3 | 4 | 6 | 8 | 5±1.9 months |
| **Functional scores (IKDC)** | Pre-operative | 41.4 | 35.6 | 29.9 | 42.5 | 41.4 | 38.2±5.3 |
| | Post-primary repair | 59.8 | 52.9 | 43.7 | 47 | 59.8 | 54.0±6.8 |
| | Post-meniscectomy | 81.6 | 77.0 | 72.4 | 75.9 | 80.5 | 77.5±3.7 |
| **Pain score (VAS)** | Pre-operative | 7 | 6 | 7 | 7 | 6 | 6.4 |
| | Post-primary repair | 6 | 6 | 6 | 7 | 6 | 6.2 |
| | Post-meniscectomy | 3 | 2 | 3 | 2 | 2 | 2.4 |

## DISCUSSION

Several clinical studies have demonstrated that arthroscopic repair of bucket-handle meniscal tears can result in meaningful pain relief and favorable functional outcomes, particularly when performed in younger patients and within a shorter interval from injury.[4] Repair of chronic bucket-handle tears has also been reported with encouraging results in selected populations. Espejo-Reina et al reported satisfactory functional outcomes and acceptable re-operation rates following repair of chronic medial bucket-handle meniscal tears, even in cases where the delay to surgical intervention approached 10 months.[3] Furthermore, in a systematic review and meta-analysis, Costa et al reported an overall failure rate of 14.8% after arthroscopic repair of bucket-handle tears, identifying medial location and isolated tears as risk factors for failure, yet still supporting meniscal repair as a reasonable meniscus-preserving strategy in the majority of patients.[1]

In contrast to these reports, all five middle-aged patients in the present series with chronically displaced medial bucket-handle tears and a symptom duration of 8 to 10 months experienced failure of initial meniscal repair. Each patient developed recurrent pain and/or effusion necessitating conversion to partial meniscectomy. Notably, improvements in functional outcome measures were modest following repair and became clinically significant only after meniscectomy, with the greatest gains in IKDC scores and reductions in VAS pain scores observed at one-year follow-up after meniscal resection.

Available evidence indicates that multiple factors influence the likelihood of successful healing following bucket-handle meniscal repair, including patient age, chronicity of the tear, associated ligamentous pathology and intrinsic meniscal tissue quality.[4-6] Larger clinical series and systematic reviews have consistently reported higher failure rates in medial and isolated bucket-handle tears, while younger patient age and concomitant ACL reconstruction have been associated with improved repair survivorship.[1,2] These findings underscore the importance of both biological and mechanical environments in determining repair success. In the setting of chronic bucket-handle tears, prolonged meniscal displacement has been shown to result in structural deformation of the meniscus, capsulo-meniscal scarring and progressive chondral degeneration. Such changes may adversely affect meniscal reducibility, vascularity and healing potential, even when an anatomic reduction and technically sound suture repair are achieved.[3-6]

In the present series, all patients were older than 40 years, presented after a prolonged symptomatic interval of 8 to 10 months and demonstrated early chondral changes (Grade 1 to 2) at arthroscopy. Despite initial reduction and repair, all cases progressed to failure requiring partial meniscectomy. These findings lend support to the concept that age-related biological factors, chronicity of displacement and early degenerative joint changes may collectively and substantially increase the risk of repair failure in this specific patient subgroup. Chronic and displaced bucket-handle meniscal tears present unique

technical challenges that distinguish them from acute, reducible injuries. With increasing chronicity, prolonged displacement of the torn fragment may result in deformation of the meniscal tissue, loss of intrinsic elasticity, tightening of the medial compartment and the development of dense capsulo-meniscal or intercondylar adhesions. These changes can hinder arthroscopic reduction and increase tension across the repair site, thereby compromising the biological and mechanical environment required for healing, even when technically sound fixation is achieved.[5,6] To overcome these challenges, several authors have described adjunctive arthroscopic techniques aimed at improving exposure, mobilizing the incarcerated fragment and facilitating stable repair in chronic cases. Alabi et al reported a structured approach for chronic isolated medial bucket-handle tears that included controlled release of the posterior fibers of the medial collateral ligament to improve medial compartment access, allowing anatomic reduction and combined inside-out and all-inside fixation, with encouraging short-term clinical outcomes.[7]

Such strategies highlight the importance of adequate visualization and fragment mobility when attempting meniscal preservation in delayed presentations. In addition, capsulo-meniscal release techniques have been proposed to address restricted meniscal mobility caused by chronic adhesions. By releasing tethered peripheral attachments, these techniques aim to reduce tension on the repaired meniscus, facilitate reduction in locked knees and potentially avoid meniscectomy in selected chronic bucket-handle tears.[8] However, concerns remain regarding the altered biomechanics of the meniscus after extensive release and the uncertain healing potential of chronically displaced or degenerative tissue. With respect to fixation methods, long-term series comparing all-inside and inside-out repair techniques suggest that both constructs can yield satisfactory survivorship and functional outcomes in appropriately selected patients. Importantly, failure rates appear to be more strongly influenced by tear characteristics such as medial location, chronicity and associated pathology, than by the choice of suture technique alone.[9]

In the present series, all patients underwent adhesiolysis followed by meniscal repair using conventional suturing techniques, without adjunctive procedures such as medial collateral ligament release or formal capsulo-meniscal release. Three of five knees demonstrated extensive adhesions at arthroscopy, reflecting advanced chronicity. Despite achieving apparent anatomic reduction and stable fixation, all repairs failed within a short postoperative interval. These findings suggest that in middle-aged patients with delayed presentation and adherent chronic bucket-handle tears, standard repair techniques alone may be insufficient and that either more aggressive mobilization strategies or alternative treatment pathways should be carefully considered. Meniscal preservation has been strongly advocated because meniscectomy, particularly when extensive, is associated with increased tibiofemoral contact pressures, accelerated cartilage degeneration and a substantially higher long-term risk of radiographic osteoarthritis compared with intact or successfully repaired menisci.[10,11] Classic biomechanical work by Baratz et al demonstrated that total medial meniscectomy can reduce tibiofemoral contact area by approximately 75% and increase peak contact pressures by more than 200%, alterations that have been correlated with a markedly increased risk of osteoarthritis in long-term clinical follow-up.[10-12] Contemporary systematic reviews comparing meniscal repair with meniscectomy, particularly for posterior horn and complex medial tears, further support this chondroprotective effect, reporting lower rates of osteoarthritis progression and superior functional outcomes following repair, despite higher early reoperation rates.[11-13] Long-term series focusing on bucket-handle meniscal repairs similarly indicate that, although failure rates, especially for medial tears can be substantial, successful repairs are associated with better knee function and reduced osteoarthritis at 7 to 10 years, reinforcing repair as the preferred strategy in young patients without established degenerative changes.[14,15]

The influence of surgical timing, however, appears to be more nuanced. A recent retrospective study evaluating bucket-handle meniscal tears reported that, within a window of days to a few weeks, time to surgery did not significantly affect mid-term outcomes, challenging the concept that all such injuries require emergency intervention, while still advocating repair as early as reasonably possible.[16] Importantly, most available data pertain to acute or subacute presentations, with delays measured in days or weeks rather than the prolonged delays of several months that are commonly encountered in real-world practice.

This distinction is particularly relevant in low- and middle-income country (LMIC) settings, where barriers such as limited access to specialized care, socioeconomic constraints and prolonged referral pathways frequently result in delayed presentation. Broader studies on knee injuries have demonstrated that delayed access to care and delayed ligament reconstruction are associated with a higher prevalence of complex, degenerative and irreparable meniscal pathology at the time of surgery, underscoring the role of system-level factors in determining meniscal salvageability.[17,18] Within this context, the present series reflects a scenario that is frequently encountered in LMIC environments: middle-aged patients presenting after 8 to 10 months of persistent symptoms, with chronically displaced medial bucket-handle tears, extensive adhesions and early chondral wear.

In all cases, attempted meniscal repair failed and durable symptom relief was achieved only after partial meniscectomy. These findings do not contradict the well-established principle that meniscal repair should be prioritized in young patients with reparable bucket-handle tears. Rather, they suggest that in older individuals with prolonged symptom duration and early degenerative

changes, the balance between the theoretical long-term chondroprotective benefits of repair and the practical risk of early failure may shift. In such cases, careful patient selection, realistic pre-operative counselling and a lower threshold for primary or early meniscectomy may represent a more pragmatic and patient-centered treatment strategy. This study has several important limitations that should be acknowledged. First, the sample size is small and conclusions drawn from five patients cannot be generalized to the broader population of middle-aged individuals with chronic bucket-handle meniscal tears. Second, the retrospective design and single-center nature of the study introduce the potential for selection bias and the absence of a comparison group treated with primary meniscectomy limits the ability to directly contrast treatment strategies.

Third, although surgical technique and postoperative rehabilitation followed a broadly standardized protocol, minor variations in operative execution and rehabilitation progression may have occurred over time. In addition, objective imaging or second-look arthroscopic confirmation of meniscal healing was not performed prior to conversion to meniscectomy and failure was defined on the basis of persistent or recurrent clinical symptoms. Finally, while clinical outcomes were assessed at one year following meniscectomy, long-term radiographic follow-up was not available. Consequently, the impact of early meniscectomy on the progression of osteoarthritis in this specific subgroup of middle-aged patients with chronic bucket-handle tears could not be evaluated.

## CONCLUSION

In this case series, arthroscopic repair of chronically displaced medial bucket-handle meniscal tears in middle-aged patients presenting after prolonged delay resulted in a high rate of early clinical failure, with all patients ultimately requiring partial meniscectomy. Meaningful improvements in pain and function were observed only after meniscectomy. While meniscal repair remains the preferred treatment for acute bucket-handle tears in younger patients, increasing age, prolonged symptom duration, extensive adhesions and early chondral degeneration appear to substantially reduce the likelihood of successful repair in this subgroup. In settings where delayed presentation is common, careful patient selection, realistic pre-operative counselling and consideration of early meniscectomy may represent a more pragmatic treatment approach.

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