



ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION WITH INSIDE-OUT MENISCAL REPAIR IN A 19-YEAR-OLD MALE WITH ACL TEAR AND BUCKET-HANDLE LATERAL MENISCUS INJURY

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Abstract

Anterior cruciate ligament (ACL) injuries are common in young athletes involved in pivoting and contact sports and are frequently associated with concomitant meniscal tears. Combined injuries significantly compromise knee stability and may predispose to early degenerative changes if not managed appropriately. We report the case of a 19-year-old male who presented with persistent left knee pain and instability one year following a slip-and-fall injury sustained while playing kabaddi. Clinical examination revealed positive anterior drawer, Lachman, and McMurray's tests. Magnetic resonance imaging confirmed a near-complete ACL tear with a bucket-handle tear of the lateral meniscus. The patient underwent arthroscopic ACL reconstruction combined with inside-out lateral meniscal repair using a spinal needle technique. Intra-operative findings demonstrated a displaced longitudinal meniscal fragment, which was reduced and secured using multiple sutures. ACL reconstruction was performed with anatomical tunnel placement and graft fixation. Post-operative rehabilitation included early quadriceps activation, controlled range of motion, and progressive strengthening. At follow-up, the patient demonstrated restored knee stability and satisfactory functional recovery. This case highlights the importance of early diagnosis, meniscal preservation, and combined surgical management in young active individuals to restore biomechanics and reduce long-term risk of osteoarthritis.

Keywords: Anterior cruciate ligament; ACL reconstruction; Bucket-handle tear; Lateral meniscus; Inside-out meniscal repair; Arthroscopy; Sports injury; Knee instability; Meniscal preservation; Young athlete.



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INTRODUCTION

The anterior cruciate ligament (ACL) is a primary stabilizing structure of the knee joint, responsible for preventing anterior translation of the tibia and controlling rotational movements during dynamic activities (1). Integrity of the ACL is essential for maintaining normal knee kinematics, particularly during high-demand sports involving pivoting, cutting, and sudden deceleration. ACL injuries are common among young athletes participating in contact and rotational sports such as kabaddi, football, and basketball (2). These injuries typically result from non-contact mechanisms involving valgus stress combined with internal rotation, or from direct trauma during sports activities (3).

Meniscal injuries frequently accompany ACL ruptures due to the shear and rotational forces transmitted across the tibiofemoral joint at the time of injury (4). Among these, bucket-handle tears represent a significant subtype characterized by a displaced longitudinal tear of the meniscus, often leading to mechanical symptoms such as locking, catching, and restricted range of motion (5). The lateral meniscus, in particular, is vulnerable in acute ACL injuries due to its increased mobility and biomechanical role in load transmission (6).

If left untreated, combined ACL and meniscal injuries can lead to chronic instability, altered joint biomechanics, progressive cartilage degeneration, and early onset osteoarthritis (7). Preservation of meniscal tissue has become

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increasingly important in contemporary orthopedic practice because meniscectomy has been associated with higher rates of long-term degenerative changes (8).

Arthroscopic ACL reconstruction combined with meniscal repair is currently considered the standard of care in young, active individuals with repairable meniscal tears (9). This combined approach restores mechanical stability, improves the biological environment for meniscal healing, and reduces the risk of secondary chondral damage (10). Early surgical intervention, followed by structured rehabilitation, plays a crucial role in optimizing functional outcomes and facilitating safe return to sports (11).

Case Presentation

A 19-year-old male patient, presented to the **Department of Orthopedics, Outpatient Department (OPD), Mamata Medical College, Khammam**, with persistent left knee pain and instability for one year following a slip-and-fall injury sustained while playing kabaddi. The initial episode was associated with swelling and difficulty in weight-bearing. Over time, the patient experienced recurrent giving-way episodes, difficulty in squatting, pain during pivoting movements, and occasional mechanical locking. On physical examination of the left knee:

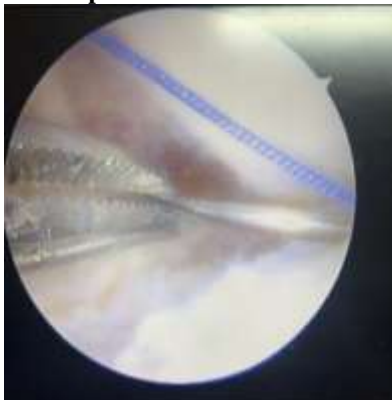
- **Anterior Drawer Test – Positive** (increased anterior tibial translation)
- **Lachman Test – Positive** (suggestive of ACL insufficiency)
- **McMurray’s Test – Positive** (indicative of meniscal pathology)

Magnetic resonance imaging confirmed a **near-complete tear of the anterior cruciate ligament (ACL)** along with a **bucket-handle tear of the lateral meniscus**. Considering the patient’s young age and functional demands, arthroscopic ACL reconstruction with simultaneous meniscal repair was planned.

Intra-operative Findings and Surgical Technique

The procedure was performed under spinal anesthesia with the patient in supine position. Standard anterolateral and anteromedial portals were established.

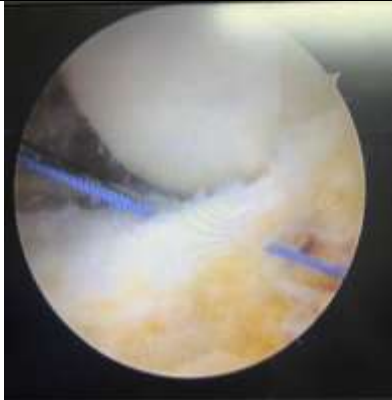
Figure 1 – Arthroscopic Visualization of Bucket-Handle Tear



The initial arthroscopic survey revealed a displaced longitudinal tear of the lateral meniscus consistent with a **bucket-handle configuration**.

The torn fragment was seen displaced centrally toward the intercondylar notch. The peripheral rim remained attached, but the inner fragment was unstable and mobile upon probing. The articular surface showed distortion of normal meniscal contour, explaining the patient’s locking symptoms. The ACL fibers appeared attenuated and non-functional, confirming near-complete rupture.

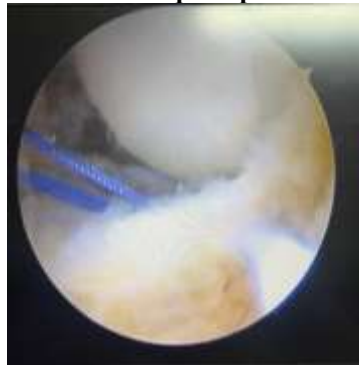
Figure 2 – Reduction of the Displaced Meniscal Fragment



Using an arthroscopic probe, the displaced meniscal fragment was gently manipulated and reduced to its anatomical position along the lateral tibial plateau. Restoration of the normal crescent shape of the meniscus was confirmed arthroscopically.

Care was taken to ensure that the fragment was viable and repairable, with adequate vascular supply along the peripheral zone.

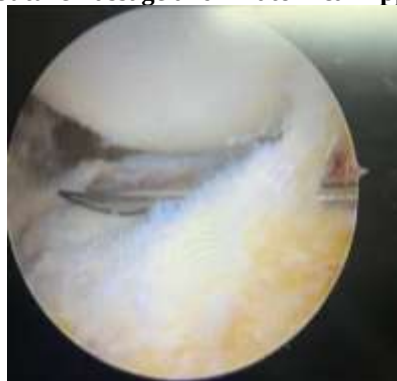
Figure 3 – Inside-Out Technique: Spinal Needle Introduction



An inside-out meniscal repair technique was employed. A spinal needle was introduced percutaneously from outside the joint capsule under arthroscopic guidance.

The needle was directed through the peripheral meniscal rim and across the torn fragment. Blue non-absorbable suture material is clearly visualized in the image passing through the meniscal tissue. This technique allows strong vertical mattress sutures and provides secure fixation, particularly for longitudinal and bucket-handle tears.

Figure 4 – Suture Passage and Anatomical Approximation

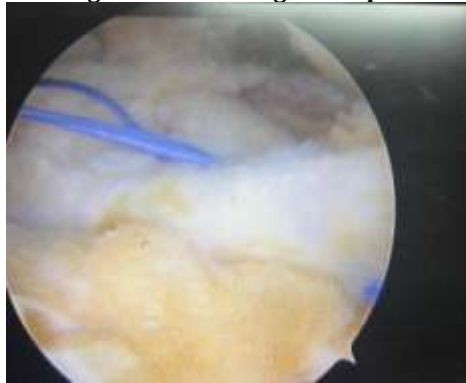


Multiple sutures were passed sequentially along the length of the tear. The displaced fragment was held in reduced position while sutures were tensioned.

The image demonstrates restoration of the meniscal contour with appropriate edge-to-edge apposition. No gapping was observed between the torn margins.

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Figure 5 – Securing the Repair



After confirming satisfactory alignment, sutures were tied over the capsule externally.

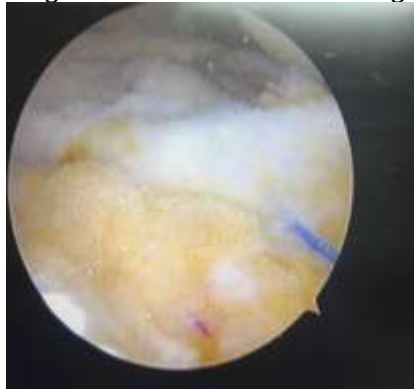
The repaired lateral meniscus appeared stable upon probing. There was no residual displacement or abnormal mobility. The hoop stress mechanism was effectively restored.

ACL Reconstruction

Following successful meniscal repair, attention was turned to ACL reconstruction.

The torn ACL fibers were debrided arthroscopically. Tibial and femoral tunnels were prepared in anatomical positions. The graft was passed through the tunnels and positioned within the intercondylar notch.

Figure 6 – ACL Graft Positioning



The graft is visualized within the intercondylar notch, appropriately aligned along the anatomical course of the native ACL. Tension was applied and fixation achieved using standard fixation devices.

Figure 7 – Final Arthroscopic Assessment



Final inspection demonstrated:

- Stable repaired lateral meniscus

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- Well-tensioned ACL graft
- Absence of impingement
- Restoration of joint congruity

The knee was taken through a full range of motion intra-operatively to confirm stability.

Post-operative Course

The patient tolerated the procedure well.

A structured rehabilitation protocol was initiated, consisting of:

- Early quadriceps activation exercises
- Controlled range of motion
- Protected weight-bearing
- Progressive strengthening and proprioceptive training

At follow-up, the patient demonstrated improved knee stability with no further episodes of instability.

DISCUSSION

Anterior cruciate ligament (ACL) rupture in young athletes represents a significant orthopedic problem due to its impact on knee stability, sports participation, and long-term joint health. In the present case, a 19-year-old male sustained a rotational injury while playing kabaddi, resulting in a near-complete ACL tear with an associated bucket-handle tear of the lateral meniscus. This injury pattern is consistent with high-energy pivoting mechanisms described in sports-related ACL injuries (2,3).

The ACL functions as the primary restraint to anterior tibial translation and contributes substantially to rotational stability of the knee (1). When disrupted, abnormal tibiofemoral kinematics occur, leading to increased shear forces across the menisci and articular cartilage. Several biomechanical studies have demonstrated that ACL deficiency significantly increases load transmission through the menisci, particularly during pivoting activities (6). This explains the high incidence of concomitant meniscal tears in ACL-injured knees, especially in young, active individuals (4).

Bucket-handle tears are longitudinal vertical tears characterized by displacement of the central fragment into the intercondylar notch. They account for a considerable proportion of repairable meniscal tears and are frequently associated with acute ACL injuries (5). In the current case, arthroscopy confirmed a displaced lateral meniscal fragment causing mechanical symptoms. If left untreated, such tears can result in persistent locking, cartilage wear, and accelerated degenerative changes (7).

Historically, meniscectomy was widely performed for such tears; however, long-term studies have demonstrated a strong association between meniscal resection and early osteoarthritis (8). Preservation of meniscal tissue is now considered crucial due to its role in shock absorption, load distribution, joint stability, and lubrication. Contemporary orthopedic practice

strongly favors meniscal repair over meniscectomy whenever feasible, particularly in young patients with peripheral vascularized tears (9).

The inside-out repair technique used in this case remains one of the gold-standard methods for repair of longitudinal and bucket-handle tears. It allows placement of strong vertical mattress sutures and provides secure fixation across the tear site. Compared to all-inside techniques, inside-out repair has demonstrated comparable healing rates with excellent biomechanical strength, especially for tears involving the posterior horn (10). Moreover, vertical sutures placed perpendicular to the tear restore circumferential hoop stress effectively (12).

Simultaneous ACL reconstruction enhances the biological environment for meniscal healing. Restoration of knee stability reduces abnormal shear stress on the repaired meniscus, thereby improving healing rates. Several studies have shown that meniscal repair performed concomitantly with ACL reconstruction demonstrates higher success rates compared to isolated repair in ACL-deficient knees (13). This is attributed to improved joint stability and increased vascular response associated with tunnel drilling during ACL reconstruction.

The decision to proceed with ACL reconstruction in this patient was justified by persistent instability, positive Lachman and anterior drawer tests, and the patient's young age and high functional demands. Current clinical practice guidelines support ACL reconstruction in young active individuals with symptomatic instability to prevent secondary meniscal and chondral damage (9).

Rehabilitation plays a critical role in postoperative outcomes. Early controlled mobilization combined with progressive strengthening optimizes graft maturation and meniscal healing (11). Excessive early loading, however, may compromise repair integrity; therefore, a

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structured, milestone-based rehabilitation protocol is recommended (14).

Failure to treat combined ACL and meniscal injuries appropriately can lead to chronic instability and progressive cartilage degeneration. Long-term cohort studies have demonstrated increased risk of post-traumatic osteoarthritis in patients with untreated or inadequately treated ACL injuries, particularly when associated with meniscal damage (7). Early anatomical reconstruction and meniscal preservation significantly reduce this risk (15).

In the present case, arthroscopic ACL reconstruction combined with inside-out lateral meniscal repair resulted in restoration of knee stability and anatomical alignment. Final arthroscopic assessment confirmed stable repair and proper graft positioning. Given the patient's age and activity level, this combined approach provides the best opportunity for return to sports while minimizing long-term degenerative changes.

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