Case Report

Ramp-like lateral meniscus tear. Description of an infrequent lesion

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ABSTRACT

Numerous studies on meniscal tears have been published, a pathology that continues to evolve in terms of treatment and patient outcomes. As our understanding of anatomy and biomechanics improves, new entities have emerged. The lateral meniscus, especially its posterior attachment, tends to be overlooked due to its greater mobility compared to the medial meniscus. Evaluating the instability of the posterior horn poses a challenge, even during arthroscopy, therefore, it is crucial to understand the posterior menisco-synovial detachment lesions, which are indeed real and, to date, haven't received enough attention in the existing literature.

The aim is to describe a new entity affecting the posterior synovial attachment of the lateral meniscus, without injury to the posterior horn of the lateral meniscus (PHLM). We also aim to present a case report detailing the intraoperative diagnosis and management of a 20-year-old patient with a sports trauma that led to a combined anterior cruciate ligament (ACL) and lateral meniscus tear managed with arthroscopic ACL reconstruction and all-inside meniscal repair.

Through conventional arthroscopic evaluation of the posterior capsule anatomy and dissections, we have identified a distinct lesion of the PHLM at the menisco-synovial junction. Further research is necessary in this field to understand the biomechanical repercussions and determine the ideal surgical management.

Lessons learnt

- The posterior attachment of the lateral meniscus is characterized by the absence of capsular tissue, revealing instead a menisco-synovial junction.
- It is crucial to differentiate between subtypes of lateral meniscus tears for appropriate treatment and ‘ramp-like’ lateral meniscus tears should be specifically identified in patients presenting with concomitant anterior cruciate ligament ruptures and associated instability.

Case Report

- A 20-year-old male presented with an anterior cruciate ligament rupture accompanied by a concomitant tear in the lateral meniscus.
- The diagnosis was a ‘ramp-like’ lateral meniscus tear, which was managed with an all-inside meniscal repair technique.
- Detailed analysis of the lesion aided in differentiating it from other subtypes of lateral meniscus tears.

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INTRODUCTION

Meniscal tears have been a focal point in knee surgery since the inception of the field [1]. Initially regarded as superfluous and often resected, the meniscus is now well-studied, revealing significant biomechanical implications of meniscal lesions [2]. Advances in anatomy and biomechanics have been driven by the observations of innovative surgeons. The initial description of meniscal ramp lesions marked a pivotal advancement [3]; it is now understood that patients with suspected posterior medial meniscus lesions should undergo thorough evaluation to avoid overlooking such injuries, which are crucial for addressing residual anterior-posterior (AP) knee laxity [4].

In this vein, equal attention should be directed towards evaluating the posterior capsulovsynovial attachment of the lateral meniscus, leading to the identification of a previously undocumented lesion, termed the ‘ramp-like’ lateral meniscus tear (see Fig. 1).

Following the discovery of the medial meniscus ramp lesion, the focus has shifted to understanding the anatomical and biomechanical significance of the posterior capsular attachment of the medial meniscus [5]. It is now known that the semimembranosus insertion to the posterior capsule, attached to the posterior horn of the medial meniscus, plays a pivotal role. During rotational and pivot shift activities that cause anterior tibial translation, the capsular branch of the semimembranosus exhibits a reflex contraction that can lead to capsular detachment [6].

Research from the Imperial College of London indicates that neglected ramp lesions might contribute to residual anterior laxity. In cases of anterior cruciate ligament (ACL) rupture accompanied by ramp lesions, ACL reconstruction alone may not suffice to prevent anterior tibial translation, necessitating posterior capsule reattachment [4]. Clinical implications of these lesions have been substantiated, sparking debate over the optimal surgical repair technique (all-inside versus posteriometal hook device), with both methods showing improved clinical outcomes, particularly in subjective scores and anterior knee stability [7].

However, the posterior attachment of the lateral meniscus has received comparatively less attention. The literature mentions a ‘Wrisberg rip’ or zip lesion, characterized by a longitudinal tear in the posterior horn of the lateral meniscus, adjacent to the anterior meniscofemoral ligament insertion, extending through the posterior horn [8]. The ‘ramp-like’ injury we describe is distinguished by a capsular-synovial flap detachment at the level of the posterior horn of the lateral meniscus, leading to destabilization and potential exposure of the meniscocemoral ligaments. This injury can be part of a continuum of conditions, potentially progressing towards a zip-type injury, involving the posterior meniscotibial ligament, or extending through the meniscocapitellar complex. We delineate the differences between a zip lesion and a ‘ramp-like’ lateral meniscus tear, with the former involving the posterior horn of the medial meniscus and the latter characterized by a detachment posterior to the meniscal tissue, separating the posterior horn from the synovial tissue (Fig. 2).

This article aims to report a case, describe the anatomy, and lesion patterns of this specific part of the knee.

CASE REPORT

We present the case of a 20-year-old male patient who experienced a rotational trauma to his right leg during soccer training three weeks prior to consultation. The patient described an incident wherein his leg was locked, and his body underwent external rotation while performing a drill. He did not seek immediate medical attention. Following initial home treatment involving rest and local management of oedema, the patient sought medical consultation due to recurrent episodes of the knee ‘giving away’ and pain during daily activities. Physical examination revealed a swollen knee with painful range of motion at maximal flexion and extension. The patient exhibited a grade II Lachman and anterior drawer test, associated with a grade I pivot shift. Positive McMurray and Appley tests for the lateral meniscus were noted, suggesting a potential combined ACL and lateral meniscus tear. Radiographic examination showed no fractures or dislocations. Magnetic resonance imaging (MRI) revealed a proximal ACL rupture with bony edema in the anterolateral tibial plateau. While no clear meniscus lesions were observed and the meniscal tissue appeared intact, T2 fluid-sensitive sequences, particularly in axial cuts, revealed fluid posterior to the posterior horn of the lateral meniscus (PHLM) in a longitudinal disposition, that could indicate of a ‘ramp-like’ lateral meniscal tear. These findings warranted surgical intervention and planning for ACL reconstruction using a bone-tendon-autograft technique and meniscal suture (Fig. 3).

SURGICAL TECHNIQUE

Under regional anesthesia, the patient was positioned supine with the affected leg placed over the table and supported by a lateral leg holder. Bone-tendon-autograft harvesting was performed as described by Wilding et al. [9]; a tibial bone plug and patellar tendon autograft was obtained, and instead of harvesting a patellar bone plug, the peristeme was excised and prepared. This resulted in an 80-mm length tendon with a 9-mm diameter, where the bone plug was utilized for the femoral tunnel and peristeme for the tibial tunnel. Conventional arthroscopic portals (anterolateral and anteromedial) facilitated diagnostic arthroscopy, confirming the ACL rupture and revealing a ‘ramp-like’ lateral meniscus tear, characterized by an erythematous base posterior to the PHLM (Fig. 4). The focus of this case report is not the standard ACL reconstruction procedure which has fixed with a titanium screw on the femoral side and a bioabsorbable screw on the tibial side, but rather the management of the lateral meniscus tear. Debridement of the lesion was performed to encourage bleeding and biological healing. Subsequently, an all-inside, vertical stitch suture was planned, incorporating synovial tissue at the superior and inferior margins of the meniscus (Fig. 5). Care was taken to avoid over-tightening the suture, preventing potential radial ruptures due to excessive force. The final assessment confirmed the closure of the lesion posterior to the PHLM, with restored stability of the meniscal tissue (Fig. 6).

Postoperative management involved immobilizing the knee in extension and immediate initiation of rehabilitation using a non-weight bearing protocol for four weeks, to promote healing of the meniscal suture. After the first month, patients are encouraged to discontinue all walking aids and begin physical therapy focused on achieving full range of motion and passive mobility.
ANATOMY

The lateral meniscus is distinct from the medial meniscus in several respects, with one of the most notable being its greater mobility (Fig. 7). This increased mobility is attributed to the hiatus where the popliteal tendon traverses the posterolateral corner of the knee. A well-documented feature is the anatomy and pathology of the posterior lateral meniscus root, located 1.5 mm posterior and 4.2 mm medial to the...
Fig. 5. All inside suture placement.

Fig. 6. Tightening and final appearance of the suture.

Fig. 7. A. This image describes the posterolateral anatomy in a fresh dissection, showing the normal anatomy and illustrating the relationship between the synovial membrane, the PHLM, and its relation to the LTP and PH. B. The yellow arrows indicate the path of the posterior menisco-synovial junction of the PHLM. C. This schematic highlights the differences between zip lesions and “ramp-like” lateral meniscus tears. The cyan line denotes the location of the zip lesion, illustrating the compromise of the PHLM with some tissue still attached to the posterior synovial junction. In contrast, the yellow line indicates a pure posterior menisco-synovial junction detachment, without any compromise of the PHLM substance. PH = popliteal hiatus; LTP = lateral tibial plateau; PHLM = posterior horn of the lateral meniscus.
lateral tibial eminence. It is also positioned 12.7 mm anterior to the posterior cruciate ligament [10].

Focusing on the posterior capsulo-synovial attachment reveals several differences that contribute to the lateral meniscus’s mobility. Unlike the medial meniscus, the lateral meniscus lacks a semimembranosus insertion, a posterior oblique ligament, and a deep medial collateral ligament insertion. Additionally, it features a hiatus for the popliteal tendon, measuring 12–15 mm in width [11], located approximately at 36% of the meniscal length from the posterior root. This hiatus lacks posterior capsular attachment [12] (Fig. 8). However, medial to the popliteal hiatus, the lateral meniscus maintains a posterior synovial attachment [13], a posterior menisco-tibial ligament, popliteomeniscal fascicles [14], and meniscofemoral ligaments. These structures are crucial for stabilizing the posterior horn, preventing anterior displacement or instability of the meniscus.

**DISCUSSION**

Meniscal lesions are among the most extensively studied pathologies in orthopedic surgery. Despite this, the literature continues to reveal new lesions and provide deeper insights into biomechanics and clinical issues. In this specific context, we highlight the previously undescribed ‘ramp-like’ lateral meniscus tear.

In this case report, we present a 20-year-old male with a combined ACL injury and a posterior menisco-synovial junction separation. This case demonstrates the presence of a poorly described entity in the literature. Perhaps our most significant finding is the understanding of the posterior attachment of the lateral meniscus. Here, we identified not capsular but synovial tissue attached to the meniscal tissue. This finding, supported by histological analysis and micrography, may be key to differentiating posterior meniscocapsular lesions of the medial meniscus, commonly known as ramp lesions, from what we describe as a posterior menisco-synovial detachment of the lateral meniscus, or ‘ramp-like’ lateral meniscus tear. Additionally, this differs from the variations of the PHLM tears, mainly from longitudinal tears and zip lesions or Wrisberg rip lesions, as what we describe is a lesion in which there is no actual involvement of meniscal tissue, and the origin of the rupture begins posterior to the meniscal attachment of the meniscofemoral ligament.

To our knowledge, no articles have specifically described the type of lesion highlighted in our case report. A few articles have discussed similar lesions, such as occult posterolateral menisco-capsular separation, as a cause of persistent lateral pain in the setting of a normal or inconclusive MRI [15]. These were identified through increased lateral meniscus excursion with probing under direct arthroscopic visualization and treated with all-inside sutures. However, as described in our article, with microphotography and histological analysis, there is no capsular attachment to the PHLM, leading us to believe those lesions described are what we refer to as the ‘ramp-like’ lateral meniscus tear.

Another described cause of increased lateral meniscus mobility is the well-studied popliteomeniscal fascicile tears [16]. These are an important part of the posterolateral corner of the knee and provide stability to this area [14,17]. Anatomical descriptions of these lesions show that the tears occur in relation to the popliteal hiatus, more laterally than what we describe.

In conclusion, distinguishing between the ‘ramp-like’ lateral meniscus tear and other injuries such as the zip lesion or Wrisberg rip is crucial. The primary differentiating factor is that the latter affects the substance of the posterior horn of the lateral meniscus, whereas the ‘ramp-like’ tear occurs at the menisco-synovial junction, leaving the posterior horn intact. This distinction is vital for accurate diagnosis and effective treatment planning.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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**References**


Fig. 8. Histological image of a biopsy from the menisco-synovial junction of the PHLM, stained with hematoxylin-eosin. The solid black line indicates the fibrocartilage tissue of the posterior meniscus horn. The solid red arrow points to the synovial tissue, and the dotted black lines represent the junction where ‘ramp-like’ lateral meniscus tears are typically observed.