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Original Articles

Evaluating a Puncture Injury of the Plantaris and Achilles Tendons Using Handheld Point-of-Care Ultrasound: A Case Report

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ABSTRACT

Objective: This report describes the use of point-of-care ultrasound in the evaluation of a traumatic puncture injury to the posterior calf affecting the Achilles and, unexpectedly, the plantaris tendon.

Methods: A 43-year-old male presented three days after sustaining penetrating trauma to the posterior calf from a dropped drill with an attached bit. Initial hospital urgent care evaluation was performed without imaging. The patient subsequently underwent evaluation with handheld point-of-care musculoskeletal ultrasound. Both longitudinal and transverse imaging were performed.

Results: Point-of-care ultrasound showed the majority of the Achilles was intact. Unexpectedly the drill bit had managed to graze the plantaris tendon. Ultrasound was able to evaluate the extent of the injury.

Conclusion: Point-of-care ultrasound can be used to identify injured structures in a puncture injury.

Key Words: Plantaris, Achilles, Point-of-care ultrasound, POCUS, MSK ultrasound

INTRODUCTION

The Achilles tendon is the most commonly ruptured tendon in the body.[1] One of the best ways to evaluate the Achilles tendon for a tear or rupture is via diagnostic ultrasound.[2] The plantaris is typically injured at the level of the posterior proximal calf, near the musculotendinous junction.[3] It is not a typical structure to evaluate at the level of the Achilles tendon except as a pitfall in the context of an Achilles rupture where the plantaris tendon can be mistaken as part of the Achilles tendon resulting in the incorrect diagnosis of a partial tear instead of a full rupture.[4]

The plantaris tendon is found in roughly 9 out of 10 individuals.[5,6] It is rarely injured compared to other leg structures in cases of Achilles tendinopathy or "tennis leg".[7,8] In one study on calf strains, a plantaris tear was detected in only 1.4% of cases.[9]

Musculoskeletal ultrasound requires a high frequency linear probe.[4] Handheld ultrasounds have improved greatly in recent years with multiple models that meet this criterion.[10-13] These units are affordable and portable increasing patient access to point-of-care ultrasound (POCUS) in outpatient settings.

CASE PRESENTATION

The patient was carrying a drill with an attached bit on a belt clip. As he was ascending stairs, it fell, bit first, onto the midline of the right posterior calf, puncturing the Achilles tendon. The drill bit was dislodged immediately by the weight of the drill. He was taken to the emergency department where he received stitches and a boot brace.

He reported to a chiropractic clinic 3 days later where ultrasound was used to determine the extent of the Achilles injury. Ultrasound imaging was performed with a handheld Clarius L7HD3 (Clarius Mobile Health Corp., Vancouver, BC, Canada). Some of the initial images can be seen in Figures 1 and 2. The Achilles tendon is split longitudinally with the majority of the tendon fibers still intact. It was only on inspecting the images and recorded cineclips after the visit, that the plantaris injury was detected. The plantaris was hypoechoic (darkened) at the injury site. A hypoechoic tendon could indicate an imaging artifact (anisotropy), a tendinitis, a tendinosis, a partial tendon tear, or the absence of the tendon, as would be the case in a full rupture.[4] On the cineclips, it is clearer that there are some signs of continuous fibers and there is a lack of clear tendon stumps; both of these findings help rule out a complete rupture. A partial tendon tear is the most likely diagnosis.

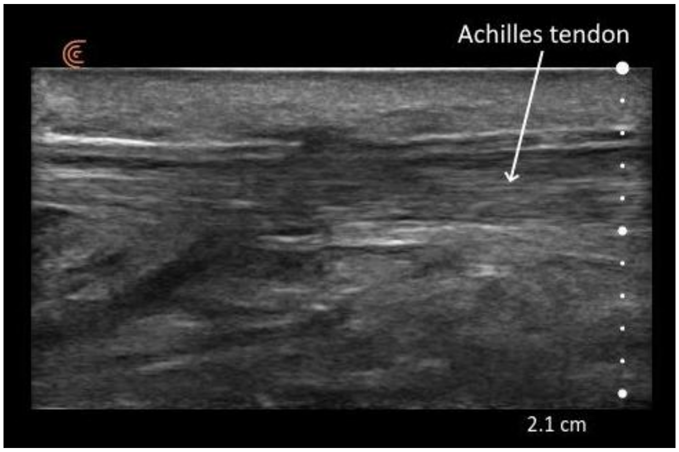

Figure 1: Longitudinal images of the injury site. Note the discontinuity of the fascia superficial to the tendon. Hypoechoic fluid was seen tracking along the paratenon. The extent of the injury was unclear based solely on the longitudinal image.

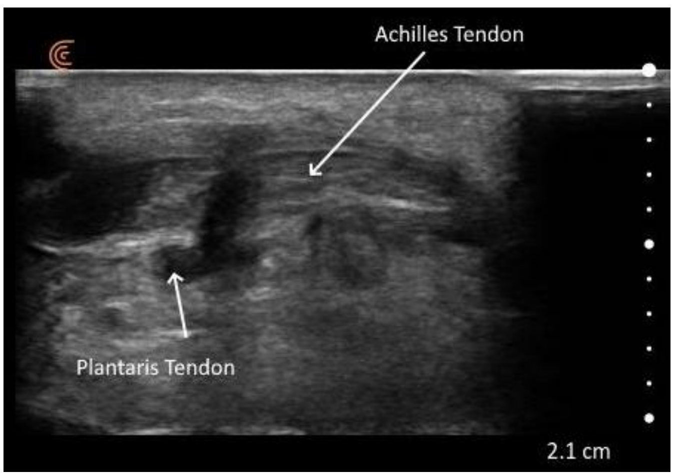

Figure 2: Transverse view of the injury site. Note the puncture passed by the location of the plantaris. The plantaris was thickened and hypoechoic in the vicinity of the injury site.

DISCUSSION

Puncture injuries to the calf are most commonly caused by bicycle spokes and depending on the severity, a surgical consult could be appropriate.[14] Since imaging was not done at the hospital, having access to diagnostic ultrasound to determine the extent of the tear can be useful to guide management. Another advantage of having access to POCUS is that progress can be easily monitored and the imaging device can also be used in ultrasound guided injections should they be indicated.

A puncture of the Achilles tendon was expected considering the location of the puncture injury, but the plantaris was not at the forefront of the clinician's mind. The plantaris is typically injured at the level of the knee and not at the level of Achilles tendon.[4] This case serves as a reminder of the path of the tendon and that the tendon should be kept in mind in cases with significant Achilles injury.[4] It can be difficult to locate and identify without following the tendon with dynamic imaging. The exact distal attachment can vary but it attaches superficial, lateral, and/or deep to the Achilles tendon on the lateral side.[15] As an ultrasound transducer moves proximally, you should see the tendon move from lateral to medial deep to the Achilles tendon.

This case also shows the importance of imaging in two planes and in taking cineclips. The initial clinician, understandably, had not seen an injury like this, and correctly took cineclips of the region in two axes. Ultrasound imaging can be a dynamic imaging modality, and a moving image gives more information than a static one. A hypoechoic circular structure could be a blood vessel, a hematoma, an injured tendon, a ruptured tendon, or even an injured nerve.[4] By following a structure and/or by using compression, the answer may become clear. In this case, tendon stumps were not seen, and we could see normal tendon appearance proximal and distal to the injury site.

CONCLUSION

Point-of-care ultrasound can be used to identify injured structures in a puncture injury. In this case it identified the extent of damage to the Achilles tendon and identified an injury to the plantaris tendon.

LIMITATIONS

A single case design is inherently limited and does not demonstrate the reliability of identifying a plantaris injury. Since the plantaris is not present in 100% of the population, there may be no tendon to identify.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

COMPETING INTERESTS

One of the authors offers ultrasound educational courses and consultations. The other offers injection therapy educational courses. The authors declare that they have no other competing interests.

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Horizontal Medial Meniscal Tear in a Young Athlete Following Acute Knee Trauma: A Case Report

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ABSTRACT

Title: Horizontal Medial Meniscal Tear in a Young Athlete Following Acute Knee Trauma: A Case Report

Objective: To report a horizontal medial meniscal tear in a young athlete following acute knee trauma and to emphasize the importance of timely diagnosis and appropriate referral following unsuccessful conservative management.

Clinical Features: A 24-year-old female presented with persistent right knee pain following a volleyball-related injury. A six-month course of conservative treatment failed to improve symptoms, prompting further evaluation with radiography and Magnetic Resonance Imaging (MRI).

Intervention/Outcome: MRI revealed a horizontal tear of the medial meniscus with associated chondromalacia patella. Following arthroscopic medial meniscal repair and three-months of postoperative rehabilitation, the patient was able to return to full athletic participation without limitations.

Conclusion: This case highlights that horizontal meniscal tears and associated chondromalacia patella, though typically degenerative, can occur in young and active individuals following acute knee trauma. Persistent medial knee pain unresponsive to conservative management should prompt advanced imaging to avoid delayed diagnosis. Early recognition and appropriate surgical intervention resulted in excellent functional recovery for this patient.

INTRODUCTION

Meniscal injury is among the most common soft tissue injuries of the knee, frequently affecting young athletes, with a reported prevalence of approximately 23% in high school athletes. The incidence and prevalence of meniscal tears increase with age, reaching an estimated 31% among individuals between 50 and 90 years of age.[1] During development, the menisci are highly cellular and well-vascularized, receiving blood supply from branches of the medial, lateral, inferior, and middle geniculate arteries that enter peripherally and extend through the entire width of the menisci.[2] In contrast, by adulthood, vascularity is limited to approximately 10%-30% of the peripheral meniscus.[3] Owing to the avascular nature of the inner two-thirds of the meniscus, healing potential is limited, and treatment outcomes - as well as the choice of intervention - vary according to the type and location of the tear.[4]

Management of meniscal injuries is broadly categorized into nonoperative and operative approaches. Nonoperative treatment is most commonly employed for degenerative meniscal tears and typically includes therapeutic exercise programs, such as quadriceps strengthening.

Although conservative management may provide initial symptomatic relief, current evidence suggests that approximately one-third of patients with degenerative meniscal tears ultimately require meniscectomy to achieve satisfactory pain reduction and functional improvement.[5]

Typically, surgical options include arthroscopic repair or meniscectomy, either partial or total. Partial meniscectomy remains the most frequently performed procedure; however, it can alter normal joint biomechanics and is associated with a significantly increased risk of developing osteoarthritis later in life.[6] In contrast, meniscal repair more effectively restores joint biomechanics and is believed to offer a more favorable long-term outcome compared with meniscectomy.[7] If untreated, meniscal damage is a significant risk factor for the development of early onset osteoarthritis. In addition, there is a strong positive correlation between meniscal tear and chondromalacia patella.[8] Consequently, timely and appropriate management of meniscal injuries is crucial to prevent post-traumatic, premature degenerative changes of the knee in later life.[6,7]

The current case report is unique for the following reasons. Horizontal meniscal tears are uncommon in young athletes and are more commonly associated with degenerative changes in older individuals. Second, although often asymptomatic, horizontal tears can be clinically significant and concerning when symptomatic in this population.[9] This report describes a case of symptomatic horizontal meniscal tear in a young female athlete who failed to respond to conservative management and ultimately underwent surgical meniscal repair with an excellent clinical outcome.

Chiropractic physicians commonly emphasize conservative, noninvasive care and generally refer patients for surgical intervention only after such measures have been exhausted. Although evidence suggests that patients who initially seek care from chiropractic physicians are significantly less likely to undergo surgical intervention compared with those who first consult medical physicians or surgeons,[10] it remains equally important for chiropractic physicians to determine when an appropriate referral should be made and what clinical conditions may be less likely to respond to conservative management to prevent long-term post-injury complications such as premature osteoarthritis.[6,7]

CASE PRESENTATION

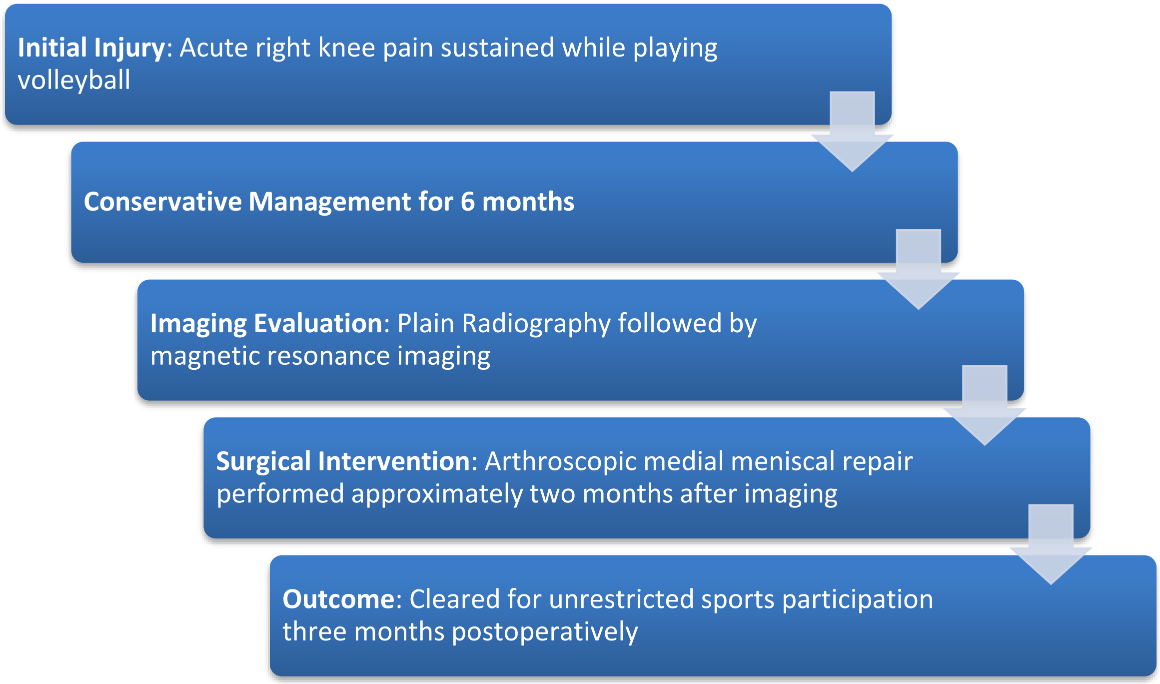
A 24-year-old female presented with acute right knee pain following a pivot shift injury while playing volleyball. Physical examination revealed tenderness to palpation along the medial joint line of the right knee. Both active and passive ranges of motion were limited secondary to pain during extension. Valgus stress testing elicited medial knee pain accompanied by an audible click. McMurray's test was positive for medial joint line pain with an associated audible click, raising clinical suspicion for a medial meniscal tear. The remainder of the physical examination was unremarkable.

The patient underwent a six-month course of conservative management consisting of weekly therapeutic exercise sessions and low-level laser therapy. The exercise program included banded terminal knee extensions (2 sets of 15 repetitions), 12-inch box jumps (2 sets of 15 repetitions), bodyweight squats (2 sets of 15 repetitions), double-leg hamstring sliders (2 sets of 10 repetitions), banded hamstring curls (2 sets of 15 repetitions), side planks (2 sets of 30-second holds), and balance training on a foam pad with ball-catching activities (2 sets of 30 seconds).

Despite treatment, she reported persistent medial knee pain with progressive worsening of symptoms, including frequency of pain, joint locking, and clicking. The patient noted episodes of knee locking during stair ascent and exacerbation of pain and clicking while squatting. After six months of failed conservative treatment and progression of symptoms, plain radiographs of the right knee were obtained and demonstrated no abnormal findings. Subsequent magnetic resonance imaging (MRI) revealed a horizontal tear of the medial meniscus and chondromalacia patella.

Approximately two months after the MRI diagnosis, the patient underwent arthroscopic medial meniscal repair with concomitant patellar chondroplasty. Following a three month postoperative rehabilitation program, the patient was asymptomatic and was cleared for unrestricted return to athletic activity.

Chart 1. Summary of the timeline



Imaging Technique and Findings

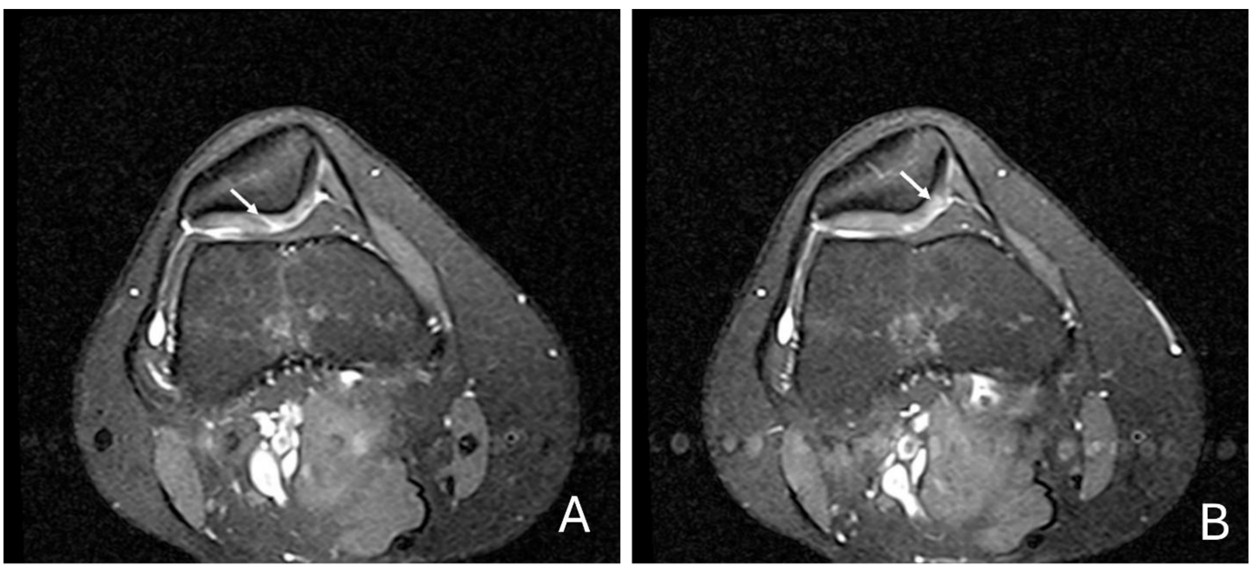
Initial radiographs performed approximately 6 months after the injury demonstrated normal anatomic alignment and did not reveal any osseous abnormality (**Figure 1**).

Figure 1: AP, lateral and tunnel views

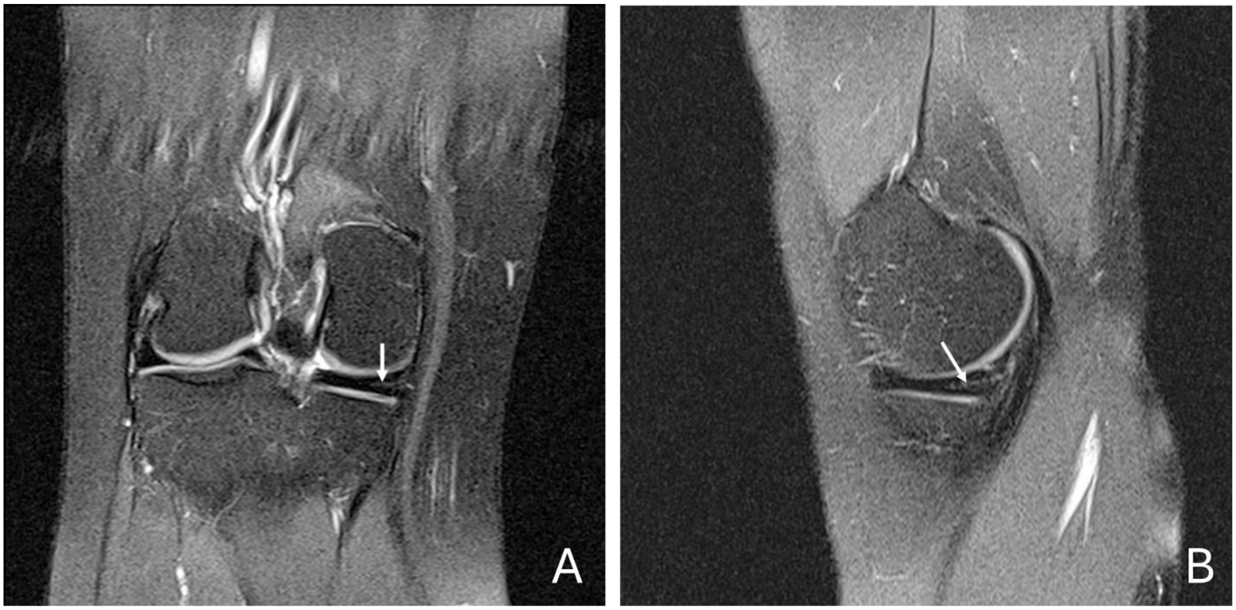
The MR images included axial PD FS, sagittal PD FS, sagittal PD, and coronal PD FS weighted images of the right knee without intravenous gadolinium-based contrast agent. Overall osseous alignment of the knee joint complex appears anatomically maintained. Based on a lateral trochlear inclination angle of approximately 14° and a trochlear depth of 3.5 mm, the findings are consistent with mild trochlear dysplasia. Trochlear dysplasia is a structural abnormality characterized by a shallow femoral trochlear groove and is strongly associated with patellofemoral instability and the development of chondromalacia patellae.[11]

The most significant MR findings include cartilage abnormality along the medial and lateral patellar facets and the medial meniscus. There is a linear focal defect along the medial aspect of the lateral patellar facet articular cartilage (**Figure 2A**). There is focal swelling, fissuring, and increased signal intensity of the patellar cartilage of the medial facet (**Figure 2B**). This is likely compatible with grade III chondromalacia patella according to the Outerbridge grading system[12] and is highly associated with trochlear dysplasia. There is a thin line of increased signal intensity within the medial meniscus, which runs parallel to the tibial plateau extending from the midbody to the anterior aspect of the posterior horn, dividing the meniscus into its superior and inferior parts seen on coronal (**Figure 3A**) and sagittal (**Figure 3B**) proton density fat suppression images.

Figures 2A and 2B: Axial proton density fat suppression images

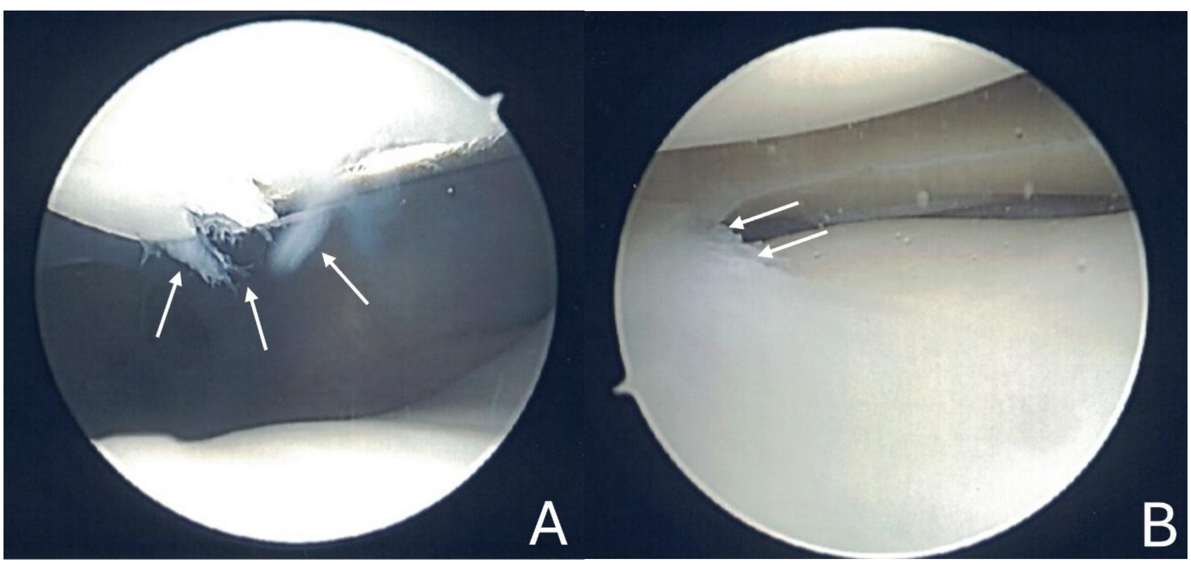


Figures 3A and 3B: Coronal (A) and sagittal (B) proton density fat suppression images



Diagnostic arthroscopy confirmed selected MRI findings, demonstrating significant fissuring of the retropatellar articular cartilage (**Figure 4A**) and fraying of the medial meniscus (**Figure 4B**). The horizontal meniscal tear, however, was not definitively visualized at arthroscopy, likely reflecting an intrasubstance tear.

Figures 4A and 4B: Arthroscopic images



DISCUSSION

The menisci are C-shaped fibrocartilaginous structures characterized by concave superior surfaces and flat inferior surfaces, forming wedge-like cross sections that conform to the convex bony contour of the femoral condyles and the relatively flat tibial plateau. The menisci serve to deepen the tibial articular surface, facilitate load transmission across the knee joint, provide shock absorption, and most importantly enhance joint stability. The medial meniscus primarily contributes to resistance against anteroposterior translational forces, whereas the lateral meniscus plays a greater role in controlling rotational stresses.

The wedge-shaped morphology of the menisci optimizes the distribution of axial loads and increases the contact area between the convex femoral condyles and the tibial plateau, thereby reducing peak contact pressures on the articular cartilage surfaces. As a result, meniscal deficiency or structural compromise/defect is associated with accelerated degenerative changes of the joint. Notably, resection of as little as 10% of meniscal tissue has been shown to contribute to the development of chondral lesions and to adversely affect both subjective and objective clinical outcome measures. Therefore, meniscal preservation is generally favored over meniscectomy whenever feasible. This consideration likely contributed to the decision to pursue arthroscopic repair rather than meniscectomy in the present case.

Meniscal tears are commonly classified into five categories based on configuration of tear, including horizontal, radial, oblique (parrot-beak), and complex patterns. Horizontal meniscal tears are typically associated with degenerative changes rather than acute trauma and are more frequently observed in older individuals. In contrast, meniscal tears in younger patients are most often traumatic in origin and exhibit a vertical orientation.[13]

The current case is notable for the presence of a horizontal meniscal tear accompanied by chondromalacia patella in a 24-year-old female without a known pre-existing degenerative condition. Although the onset of symptoms followed an acute volleyball injury, the tear morphology suggests that repetitive microtrauma or early alterations in meniscal matrix integrity may have contributed and cannot be definitively excluded.[14]

Magnetic resonance imaging played a pivotal role in establishing the diagnosis of a meniscal tear following unremarkable radiographic findings. Although orthopedic tests such as McMurray's, Apley's, and Thessaly's tests have traditionally been employed to evaluate suspected meniscal pathology, their diagnostic accuracy and interobserver reliability are limited.[15] On MRI, horizontal meniscal tears characteristically appear as a linear high signal intensity extending to an articular surface and are often readily identified on sagittal and coronal proton-density or T2-weighted fat suppression images. Recognition of this pattern is essential to distinguish a true tear from intrameniscal degenerative signal changes. In the current case, MRI findings correlated with the clinical examination and were utilized to guide the clinical decision for arthroscopic repair following failure of prolonged conservative management.

Selecting an appropriate treatment and management plan can be challenging and requires consideration of multiple factors. A thorough understanding of meniscal anatomy, vascularity, and tear morphology is essential in guiding clinical decision-making. As discussed previously, management of horizontal meniscal tears in young patients should prioritize meniscal preservation whenever feasible, as alterations in meniscal contour resulting from meniscectomy are associated with an increased risk of early osteoarthritic changes. Owing to its favorable long-term outcomes, meniscal repair has been more widely accepted as a preferred surgical approach. The favorable outcome observed in this case, marked by a full return to athletic activity following surgical repair and rehabilitation, highlights the potential for excellent recovery when timely diagnosis and appropriate intervention are achieved. Furthermore, this case underscores the importance of considering atypical tear patterns even in young, athletic individuals and emphasizes the diagnostic value of MRI in the evaluation of persistent knee symptoms following an injury when conventional radiographs are unremarkable.

CONCLUSION

This case demonstrates that horizontal meniscal tears and associated chondromalacia patella, although typically degenerative, may occur in young and active individuals following acute knee injury. Persistent medial knee pain unresponsive to conservative management should prompt consideration of advanced imaging to avoid delayed diagnosis. Early identification of meniscal tear and appropriate surgical intervention can result in excellent functional recovery and full return to athletic activity.

LIMITATIONS

The primary limitation of this case report is its limited generalizability. The diagnostic imaging findings, management strategy, and clinical outcome observed in a single patient may not be representative of other individuals with meniscal tears, particularly across different age groups or injury mechanisms.

Additionally, the retrospective nature of this report, combined with the absence of pre-injury diagnostic imaging, limits the ability to establish a definitive causal relationship between the reported traumatic event and the identified horizontal meniscal tear. Although the patient reported an acute onset of symptoms following a volleyball-related injury, the chronicity of the tear cannot be conclusively determined, and the presence of a pre-existing, subclinical meniscal lesion cannot be excluded.

Finally, although the patient demonstrated excellent clinical recovery following surgical repair, follow-up imaging was not obtained to confirm structural healing/integrity of the meniscus. Consequently, postoperative assessment was limited to clinical outcomes rather than radiographic, MRI, and arthroscopic confirmation.

CONSENT

Written consent for publication was obtained from the patient.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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