Clinical Multimedia: Ultrasound Examination of Medial Meniscus Posterior Root Tear

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Yu-Xuan Wu, Chien-Ping Chen, Hung-Jui Chuang

Abstract

This report outlines the case of a 52-year-old woman with continuous left knee pain. An initial assessment, suggesting a meniscal tear based on joint line tenderness and a positive McMurray test, led to an ultrasonographic investigation. The ultrasound revealed left medial meniscus extrusion without positional change from full extension to 90° flexion, a hypoechoic cleft in the medial meniscus posterior root (MMPR) area, and the notable absence of the MMPR anterior to the posterior cruciate ligament (PCL), identified as the ultrasonographic ghost sign. A subsequent MRI confirmed a medial meniscus posterior root tear (MMPRT). MMPRT is known to cause biomechanical changes similar to those in total meniscectomy, thereby accelerating osteoarthritis degeneration in the knee. Given its advantages in terms of accessibility, affordability, and the ability to provide dynamic imaging, ultrasonography is a highly valuable tool for the early diagnosis of MMPRT.

Keywords: Medial meniscus posterior root tear, Meniscus tear, Ultrasound

A 52-year-old female patient presented at the clinic, reporting persistent left knee pain for a duration of 4 months. The patient had not experienced any major trauma or undergone any knee-related surgeries. The pain exacerbated during weight-bearing activities, and despite prior conservative treatment, it had worsened over time.

During the physical examination, tenderness was observed along the left medial knee joint line, and the McMurray test yielded positive results. Based on these findings, a preliminary diagnosis of a meniscal tear was made, prompting the performance of an ultrasonographic examination. The ultrasonographic results revealed left suprapatellar pouch effusion measuring 10.6 mm in depth, as well as left medial meniscus extrusion (MME) without dynamic reduction from full extension to 90° flexion, measuring 4.4 mm and 4.6 mm, respectively (Fig. 1). Furthermore, a posterior parasagittal view revealed absence of medial meniscus posterior root (MMPR) anterior to the posterior cruciate ligament (PCL), namely the ultrasonographic ghost sign (Fig. 2). Hypoechoic cleft within the region of the MMPR was also observed in the axial view (Fig. 3). Under the impression of medial meniscus posterior root tear (MMPRT), MRI scan was arranged and disclosed the presence of a radial defect on the axial image, a ghost sign on the sagittal image, and a cleft sign on the coronal image, supporting the diagnosis of MMPRT.

The attachment point of MMPR is located about 8.2 mm anteromedial to the PCL tibial attachment site and 9.6 mm posterior to the apex of medial tibial eminence. MMPRT is classically defined as a tear within 10 mm from the root insertion, accounting for about...
Fig. 1. Ultrasonographic evaluation of change in MME from (a) knee extension to (b) knee 90° flexion using longitudinal sections parallel to the MCL. Line A was drawn connecting femoral and tibial cortex, as a baseline for measurement of MME. MM extrusion was measured 4.4 mm during knee extension and measured 4.6 mm during 90° flexion. The expected decrease in MME from knee extension to knee flexion was not seen, indicating MM pathology resulting in loss of loop tension. MCL: medial collateral ligament, MM: medial meniscus, MME: medial meniscal extrusion.

Fig. 2. Comparison of (a) sound side and (b) lesion side under the posterior parasagittal section. (a) Hyperechoic MMPR (yellow arrow) was seen anteromedial to the PCL on the sound side. (b) In the region of the yellow arrowhead, absence of hyperechoic structure (MMPR) (arrowhead, ghost sign) was observed, indicating MMPRT. MM: medial meniscus, MMPR: medial meniscus posterior root, MMPRT: medial meniscus posterior root tear, PCL: posterior cruciate ligament.

Fig. 3. (a) Axial view of the T2-weighted fat-suppressed MRI of left knee with (b) its corresponding ultrasonographic section from posterior axial view. MRI hyperintense region of lesion near the MMPR (arrowheads, radial defect), and the corresponding ultrasonographic hypoechoic region anteromedial to PCL posterior to the apex of medial tibial eminence (arrowheads, radial defect), indicate pathological disruption of MMPR. A: anterior side, L: lateral side, MM: medial meniscus, MMPR: medial meniscus posterior root, P: posterior side, PCL: posterior cruciate ligament.
one quarter of all medial meniscus tears, with a general onset of more than 50 years of age.² It is often a result of trivial traumatic events, and some patients may experience a popping sensation in the knee joint upon a minor injury, followed by pain in posterior knee and along the joint line. A root tear leads to loss of hoop tension, which is of clinical significance due to its biomechanical equivalence to total meniscectomy. Ultimately, this condition causes extensive and rapid osteoarthritic degeneration.¹ In younger patients with standard lower extremity alignment without advanced joint degeneration, meniscal repair during the acute phase is the preferred approach to prevent the progression of arthritis.³ Therefore, early detection is crucial for successful treatment and a favorable prognosis.

Although MRI is the conventional diagnostic method for MMPRT, it has limitations in terms of cost, accessibility, and dynamic evaluation. Ultrasound comes in handy by providing cost-effective, readily available dynamic imaging capable of capturing various loading conditions and postures. Indirect ultrasonographic findings of MMPRT include MME exceeding 3 mm from the tibial edge and the absence of the expected reduction in MME from full extension to 90° flexion, suggesting loss of hoop tension.²⁻⁵ It is also noteworthy that ultrasonographic findings of MME alone have demonstrated an approximate sensitivity of 80 % and a specificity of 75 % in detecting MMPRT.⁶ On the other hand, ultrasonographic ghost sign and radial defect are direct findings of MMPRT. It is reasonable to assume that the accuracy may be even higher combining both direct and indirect pathological findings.

In conclusion, as demonstrated in our case, ultrasound, owing to its great accessibility and dynamic capabilities, offers valuable direct and indirect findings for the early diagnosis of MMPRT, thereby facilitating early identification and management (Video 1 Rehabilitation Practice and Science: EdiKit [researchcommons.org] in supplementary material).

Authors’ contributions

YX Wu: investigation, project administration, software, visualization, writing — original draft, writing — review & editing. CP Chen: software, writing — review & editing. HJ Chuang: conceptualization, resources, supervision, writing — review & editing.

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Conflicts of interest

None.

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