Review Article

The hypermobile and unstable lateral meniscus: a narrative review of the anatomy, biomechanics, diagnosis and treatment options

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Objective: The purpose of this review is to improve the awareness of lateral meniscal hypermobility by describing its relevant anatomy, biomechanics, pathophysiology, imaging and arthroscopic findings as well as the treatment options.

Background: The lateral meniscus is less stable than the medial meniscus. Its important posterior stabilizers are the popliteomeniscal fascicles, the posterior capsule, the meniscofemoral ligaments and the posterior meniscotibial ligament, which are divided by a bare area, the popliteal hiatus. Atraumatic insufficiency or rupture of one of these key structures may impact the mobility of the lateral meniscus and can lead to an unstable, hypermobile lateral meniscus. Lateral meniscus hypermobility can cause lateral knee pain and mechanical symptoms as locking. Ruptures of the popliteomeniscal fascicles are frequently associated with anterior cruciate ligament and posterolateral corner injuries. Their repair may be important to fully restore knee stability.

Methods: This is a narrative overview of the literature synthesizing current knowledge about the hypermobile lateral meniscus. Anatomy, biomechanics, diagnosis and treatment of this entity was of particular interest for this review. Literature was retrieved from PubMed database, hand searches and cross-reference checking.

Conclusions: Diagnosing lateral meniscus hypermobility is challenging since the magnetic resonance imaging are often unspecific and may show no structural alterations of the meniscus and its attachments. The only hint can be the patient's history and clinical symptoms (e.g., locking). Ultimately, the diagnosis is confirmed during knee arthroscopy, when the lateral meniscus can be mobilized over 50% of the lateral tibial plateau or lateral femoral condyle while anterior probing or by using the aspiration function during arthroscopy. Treatment includes stabilizing the posterior lateral meniscus by repairing the injured structures. Therefore, a systematic arthroscopic evaluation of the lateral compartment is important to fully recognize the problem. Repair can be achieved arthroscopically with various suturing techniques used for meniscal repair with satisfactory results and low recurrence rates.

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Keywords: Lateral meniscus (LM); lateral meniscus hypermobility (LMH); popliteomeniscal fascicles (PMF); meniscotibial ligament (MTL); meniscal repair

Received: 17 March 2021; Accepted: 02 June 2021; Published: 15 April 2022.
doi: 10.21037/aoj-21-9
View this article at: https://dx.doi.org/10.21037/aoj-21-9

Introduction

In contrast to the more stable medial meniscus, the lateral meniscus (LM) has less stabilizers at its posterolateral aspect (1,2). The important stabilizers of the posterior LM are the popliteomeniscal fascicles (PMF), the posterior capsule, the meniscofemoral ligaments (MFL) and the posterior meniscotibial ligament (MTL), which are divided by a bare area, the popliteal hiatus (2-8). Atraumatic insufficiency or rupture of one of these key structures may have a high impact on the mobility of the LM and can lead to an unstable, hypermobile LM (7,9-13). Lateral meniscus hypermobility (LMH) can cause lateral knee pain and mechanical symptoms as locking or giving way (6,7,14-18). In a stable knee, LMH is a rare condition. Its prevalence be it isolated or in association with cruciate injuries remains unknown. To date, only case reports and series are available and prospective studies on LMH are needed. However, a PMF rupture is reported in up to 25% of patients with an anterior cruciate ligament (ACL) injury and in up to 80% of patients with a grade 3 posterolateral corner injury (9,19,20). Since the PMF, MFL and MTL play a role in the rotational and anteroposterior knee stability, it may be crucial to repair these structures during ligament reconstruction (5,8,9,20-22). Both isolated LMH or LMH associated with ACL injury are often unrecognized, since the patient's history, clinical tests and magnetic resonance imaging (MRI) are unspecific (6,14,15,17,18,23,24). A dynamic arthroscopic evaluation remains the gold standard to diagnose LMH (6,15,25,26). Therefore, it is up to the surgeon to interpret the various finding before a knee arthroscopy is proposed to the patient. Knee surgeons should be aware and recognize isolated or associated LMH. The purpose of this review is to improve the awareness of lateral meniscal hypermobility by describing its relevant anatomy, biomechanics, pathophysiology, imaging and arthroscopic findings as well as the treatment options. We present the following article in accordance with the Narrative Review reporting checklist (available at https://aoj.amegroups.com/article/view/10.21037/aoj-21-9/rc).

Methods

This is a narrative overview of the literature synthesizing current knowledge about the hypermobile LM. Anatomy, biomechanics, diagnosis and treatment of this entity was of particular interest for this review. Literature was retrieved from PubMed database, hand searches and cross-reference checking.

Anatomy

The anatomy of the LM and its attachments remains a topic of debate (2-5,27-29). The area of interest in LMH runs from just lateral to the popliteal hiatus to just medial from the posterior root of the LM (2-8). The popliteus tendon (PT) splits this area when it passes through the popliteal hiatus transforming from an intra-articular into an extra-articular structure (2,3,9). The PT/muscle complex has multiple attachments to the tibia, fibular head and the joint capsule as well as to the LM via a complex of fascicles (4,30). These PMF are together with the posterior capsule, the MTL and MFL the main stabilizers of the posterolateral meniscus (2,4,8,9). *Figure 1* shows an illustration of these anatomic attachments to the LM.

The reported number of PMF is variable and many anatomical variations have been described (2-5,11,23,28-31). However, most studies identified three PMF; an anterior- (a-), a posterosuperior- (ps-) and a posteroinferior- (pi-) PMF. Although previous studies agreed on an anteroinferior fascicle (3,9), more recent studies quantified it as an anterosuperior fascicle (2,29,32). To avoid any confusion, it will be described in this review as the anterior PMF (aPMF).

The aPMF originates lateral from the PT on the mid height of the lateral aspect of the LM and runs inferoposterior where it blends in on the PT (2,29). Some authors describe the aPMF as the floor of the popliteal hiatus as it forms a sling around the PT by running from an anterosuperior to an inferoposterior direction (3,9). The aPMF is the anterior border of the superior and inferior popliteal hiatus (2,4).

The psPMF originates medial from the PT on the

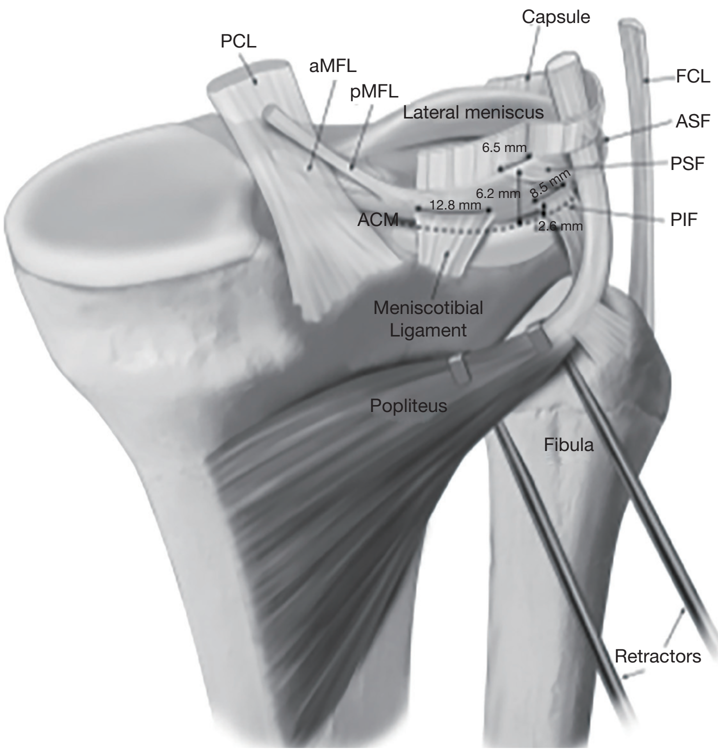

Figure 1 The important stabilizers of the posterolateral part of the lateral meniscus view from a posterior view, right knee. The inferior capsule is removed and the popliteus tendon is slightly retracted to allow better visualization of the anatomic structures [reprinted with permission from SAGE Publications, Inc. Copyright © 2019. Aman *et al.* (2)]. ASF, anterior popliteomeniscal fascicle; PSF, posterosuperior popliteomeniscal fascicle; PIF, posteroinferieur popliteomeniscal fascicle; aMFL, anterior meniscofemoral ligament; pMFL, posterior meniscofemoral ligament; FCL, fibular collateral ligament; PCL, posterior cruciate ligament; ACM, tibial articular cartilage margin.

superior margin of the LM (2,3,9,28,29). It courses directly posteriorly where it attaches to the PT (2,3,9,28,29). The aPMF and piPMF form together a hoop-like structure, called the superior popliteal hiatus (2,5).

The piPMF is inconsistently reported in anatomic studies (2,3,5,9,28,32). The piPMF originates medial from the PT on the inferior margin of the LM, it then courses inferior to join the popliteus muscle aponeurosis where it has some attachments to the tibia (2,4).

The popliteofibular ligament runs from the fibular head and inserts on the PT (5,29). Here it is in close contact with the PMF (5,29). The anterior part of the popliteofibular ligament has attachments to the aPMF and, while running along the aPMF, to the LM (5,9). Some authors refer to this direct connection between the fibular head and LM as the meniscofibular ligament (33).

Medially from the psPMF, the posterior capsule attaches on the superior margin of the LM (2).

There are two MFL, an anterior (aMFL) and posterior (pMFL) (2,34,35). A cadaveric study of 84 knees, showed that 93% of the knees have at least one MFL and in 50% both MFL were present (35). The aMFL, also known as the ligament of Humphrey, originates distal and anterior to the posterior cruciate ligament (PCL) footprint on the medial femoral condyle, runs anterior to the PCL and then inserts on the LM just lateral from the posterior root (2,34,35). The pMFL, also known as the ligament of Wrisberg, originates proximal and posterior to the PCL footprint on the medial femoral condyle, runs posterior to the PCL and then inserts on the LM lateral from the aPMF (2,34,35).

Two MTL are described, one lateral, anterior from the aPMF and one posterior, lateral from the posterior LM root (2,4,5,27,36). Both MTLs have been named coronary ligaments (4,5,29,36). The lateral MTL is part of the anterolateral ligament complex, it runs from the lateral side of the LM and inserts on the tibia anterior to the popliteal hiatus (5). The posterior MTL originates just lateral from the PCL on the tibia and inserts on the inferior margin of the posterior horn of the LM (2,5). It is reinforced by aponeurotic attachment of the popliteus muscle (2,5).

The inferior popliteal hiatus is the space between the posterior MTL and the anterior part of the aPMF (2). In contrast to the more stable medial meniscus, which has multiple stabilizers at its posteromedial aspect, the PMF and posterolateral capsule are the only stabilizers of the LM at the inferior popliteal hiatus area (1,2). This may explain why the LM is more mobile than the medial meniscus (2). Furthermore, rupture of one of these key structures may have a high impact on the stability of the LM.

A congenital deficiency of the PMF and the posterior MTL is known as the Wrisberg variant of the discoid meniscus, and is a described cause of LMH (12,16,37). In this variant, the MTL or root attachment is/are absent, but the LM presents otherwise a near normal shape (12,16,37).

Biomechanics

The PMF and the popliteus musculotendinous unit act together to restrain varus/valgus stress and coupled external rotation with posterior displacement (5,9,21,22). However, cutting the PMF in a PCL deficient knee did not show a significant increase in varus/valgus, anteroposterior and rotational stability (22). The influence of PMF rupture on the stability of the knee may therefore be minimal in comparison to the other posterolateral structures (5,22). They do have an important function in preventing intraarticular entrapment or impingement of the LM between the femoral condyle and the tibial plateau during flexion and extension movements, and have a great influence on the stability of the LM (5,8,9,20,22). The MFL may antagonize the posterior/lateral pull of the PMF and popliteus musculotendinous unit, by pulling the LM anterior/medial during knee motion and hereby controlling LM motion (8,34,38,39). Furthermore, the MFL are found to contribute to rotational and anteroposterior stability of the knee, especially when the PCL and/or the posterior root is ruptured (40-43). However, in contrast to the PMF, their biomechanical influence on the instability of the LM is not documented.

In 1997, Simonian *et al.* conducted a cadaveric biomechanical study in which they evaluated the LM mobility using a 10 N load before and after sequential sectioning of the a- and psPMF (8). After sectioning the aPMF, they demonstrated an average significant increase of anterior motion of the LM from 3.6 to 5.4 mm (8). After cutting both the a- and psPMF, they reported a significant increase to 6.4 mm of this anterior motion (8). Compared to the intact state, the LM anterior mobility increased significantly with 2.8 mm or 78% (8). Several anatomic studies evaluated the aPMF as the most robust of the PMF and concluded that the aPMF may be the most important PMF in stabilizing the LM (27-29). Furthermore, Suganuma *et al.* suggested that an abnormal or absent psPMF puts the knee at risk for instability of the LM, but a lesion of the aPMF is the essential lesion to allow the LM to become unstable (24). In agreement, Stäubli *et al.* reported that an isolated lesion of one PMF probably plays a minimal role in LMH instability (9). However, combined extended lesions of the LM stabilizers lead to a loss of LM hoop tension and consequently, to LMH (9,24). These extended lesions can include rupture of the posterior MTL (7,16). The posterior MTL provides resistance to hyperextension and posterolateral rotation of the knee (5). Consequently, rupture of the posterior MTL may influence knee and LM stability (5). To our knowledge, the biomechanical attribution of the posterior MTL to LMH has not yet been investigated.

Pathophysiology, symptoms and clinical findings

LMH may be congenital, or occur after a posttraumatic tear of one or several PMF, the posterior MTL and/or one or both MFL with or without associated ligament injury (7,9-13). Especially in young patients with bilateral atraumatic symptoms, clinicians should be conscious of a Wrisberg variant discoid LM (6,12,16,44). From an anamnestic point, a congenital variant may be difficult to distinguish from isolated posttraumatic LMH without associated ligament injury since trauma leading to this instability may be minimal and patients may often not recall any traumatic mechanism (6,9,45). Furthermore, posttraumatic LMH can be the result of repeated microtraumas (6,9,45).

The prevalence of PMF lesions in association with ligamentous knee injury is high, however may be often missed due to the focus on the ligamentous injury and its management. Stäubli *et al.* reported an isolated aPMF or psPMF tear in 25% and 7.5% of patients with an acute ACL injury and in respectively 25% and 3.6% of those with a chronic ACL injury (9). Rupture of both PMF has been reported in 25% and 21.4% of patients with acute and chronic ACL injury (9).In agreement with these findings, Temponi *et al.* recently showed a prevalence of 17.3% and 11.1% of an aPMF or a psPMF tear in ACL injured patients (19) Furthermore, Lee *et al.* found that the most common

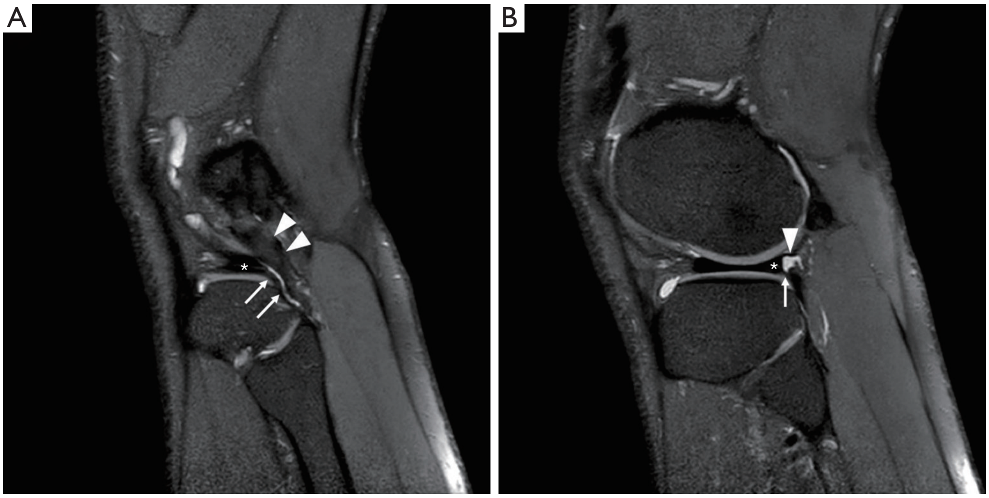

Figure 2 Sagittal T2 weighted MRI images illustrating the normal anatomy of the popliteomeniscal fascicles, right knee. In A, the arrows show the anterior popliteomeniscal fascicle, while the arrowheads show the popliteus tendon. In B, the arrow shows the posteroinferior popliteomeniscal fascicle, the arrowhead shows the posterosuperior popliteomeniscal fascicle. In A and B, the asterisks show the lateral meniscus. MRI, magnetic resonance imaging.

posterolateral corner structure injured in association with an ACL injury is the aPMF followed by the psPMF (13). If a grade 3 posterolateral corner injury is present with or without ACL injury, the aPMF, the psPMF and posterior MTL are ruptured in 60% to 85% of the cases (20).

As the posterior lateral root tear and PCL is commonly seen in association with ACL and posterolateral corner injury, the incidence of MFL rupture, which are in close relation with these structures, may be common as well (46,47). However, their presence, absence or rupture is not reported in these injuries.

The different causes of LMH lead to a variable spectrum of patients history, presentation and symptoms (6). In a stable knee scenario, common complaints include pain and mechanical symptoms such as clicking, locking and a giving way sensation in the lateral compartment (6,14,15). Locking typically occurs in deep flexion and patients may have these symptoms for years (6,45). Symptoms may even be misinterpreted as patellar instability, as reported by Arendt *et al.* (17). In a knee with an associated ligamentous injury, the patient exhibit symptoms of acute knee injury which often masquerade the symptoms of LMH.

LaPrade *et al.* described the "figure of 4" test as a diagnostic tool for LMH (15). The test consists of placing the affected knee in flexion, varus and external rotation (a "figure of 4" position), which may induce medial displacement of the LM when the PFM are ruptured (15). The test is considered positive when pain occurs that reproduces the patients symptoms at the lateral joint line (15). However, it is important to note that the test has only been validated in 6 patients (15).

MRI

The anatomy and visualization of the PMF, MFL and MTL on MRI is still debated. In uninjured knees, Johnson and De Smet visualized the a- and psPMF in 97.0% of the patients (31), whereas Sakai *et al.* could visualize the aPMF and the psPMF in respectively 94.1% and 88.2%, in a total of 34 cases (23). The piPMF is less described on MRI. In a cadaveric MRI study involving 10 knees, Peduto *et al.* identified the a- and psPMF in all specimens, whereas the piPMF was only identified in 4 cases (48). *Figure 2* shows the normal anatomy of the PMF on MRI. To improve its visualization on MRI, Sakai *et al.* recommends MRI to perform T2 weighted 45° oblique coronal images with a 3-mm slice thickness (23). However, visualization of PMF alterations on MRI does not necessarily imply LMH (23,24). Suganuma *et al.* evaluated 238 MRIs from 142 patients with (unilateral) atraumatic knee pain who underwent bilateral knee MRIs (24). LMH was confirmed in 16 (21%) of the 76 joints who underwent arthroscopic evaluation (24). They found abnormal psPMF on MRI in 41% and abnormal aPMF in 26% of the control group (222 knees) and in all

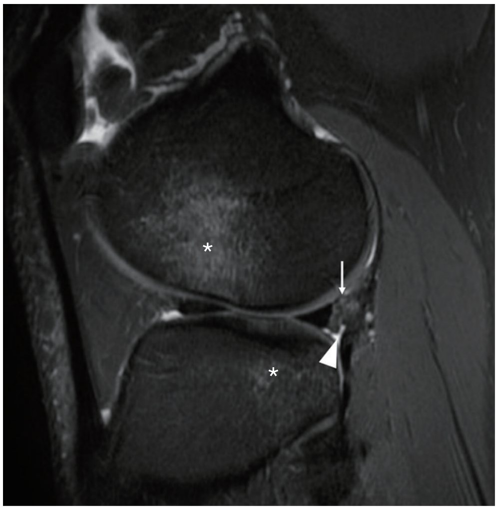

Figure 3 Sagittal T2 weighted MRI image, right knee. Preoperative MRI of a patient with ACL rupture, 4 weeks after trauma, showing characteristic bone bruise pattern (asterisks) on the lateral femoral condyle and the lateral tibial plateau. The MRI showed alterations of the posterosuperior popliteomeniscal fascicle (arrow) and a tear of the posteroinferior popliteomeniscal fascicle (arrowhead). The patient underwent anterior cruciate ligament reconstruction. Intraoperatively, the lateral meniscus was diagnosed as unstable on aspiration and probing without showing a meniscal tear. The lateral meniscus was repaired using two all-inside sutures placed medial from the superior popliteal hiatus. MRI, magnetic resonance imaging; ACL, anterior cruciate ligament.

patients with LMH (16 knees) (24). At the same time, just as alterations in PMF anatomy do not necessarily imply LMH, a normal MRI does not necessarily rule out LMH (17). Retrospective evaluation of MRIs of unstable lateral menisci did not always show alterations of the PMF (17,18). Ahn *et al.* reported that in a retrospective evaluation of 17 out of 24 patients operated for LMH, the MRI findings showed no abnormalities (18). Consequently, clinicians cannot deduct from an MRI if the LM is hypermobile (24). However, several indirect signs for the LMH have been highlighted, such as discontinuity of the PMF (*Figure 3*), rupture or absence of the posterior MTL and a water-signal between the posterior capsule and the posterior horn of the LM (11,23,44). Recently, widening of the popliteal hiatus on MRI has been described as a sign for LMH (49). In certain unusual cases, MRI was performed when the LM was dislocated (*Figure 4*) (50-52). Rupture or absence of the MFL have not been described as sign of LMH. However, as they are important stabilizers of the LM, they should be evaluated during the MRI workup (8,34,38,39). In an MRI study of 446 knees, Ebrecht *et al.* found in 70.6% of the cases at least one MFL on MRI (53). The aMFL and pMFL were found on MRI in 21.8% and 53.1% of the cases, respectively. In 4.5% of the MRIs, both ligaments were found. These numbers are markedly lower than the prevalence of the MFL found in cadaver studies (35,53).

The main explanation for the lack of sufficient sensitivity of MRI in the diagnosis of LMH is that LMH is a dynamic pathology and MRI, as a static investigation, may not be fully suited as diagnostic tool. However, if the MRI investigation shows alterations of the PMF, MFL or posterior MTL in the presence of adequate mechanical symptoms, LMH should be highly suspected.

Arthroscopic evaluation

As knee arthroscopy is the only option to properly dynamically evaluate the LM, it currently remains the gold standard for the diagnosis of LMH. The arthroscopic evaluation initially includes a visual inspection of the LM and lateral compartment cartilage as well as the level of opening of the lateral compartment. A “drive-through sign” is present if there is an increased opening of the posterolateral compartment and is a sign of posterolateral corner injury (20). The popliteal hiatus can be observed from the anterior view, especially when there is an increased opening of the lateral compartment. Widening of the popliteal hiatus may indicate LMH (18). The dynamic evaluation for LMH is done by probing and aspiration (with arthroscope or shaver) (7,15,26). Translation of the posterolateral LM by over 50% of the lateral tibial plateau, lateral femoral condyle or “beyond the equator” is considered as unstable (*Figure 5*) (6,15). In addition, moving the knee from a more flexed to a more extended position during the “figure of 4” position also allows to assess for excessive translation of the LM. If the forward translation is not conclusive, the presence of an osteochondral lesion at the posterior lateral femoral condyle or at the posterior lateral tibia plateau, as a sign of repetitive luxation of the LM, may aid in diagnosing LMH (14,18). For further the assessment of the PMF and posterior TML, a 30° arthroscope can be placed in the lateral gutter, while the knee is slightly flexed and placed in valgus. Here, the superior popliteus hiatus, the PT and the integrity of the a- and psPMF (*Figure 6*) can be evaluated (9,15). Medial LM subluxation and PMF rupture may be seen by placing varus stress on the knee, by performing anterior traction with a

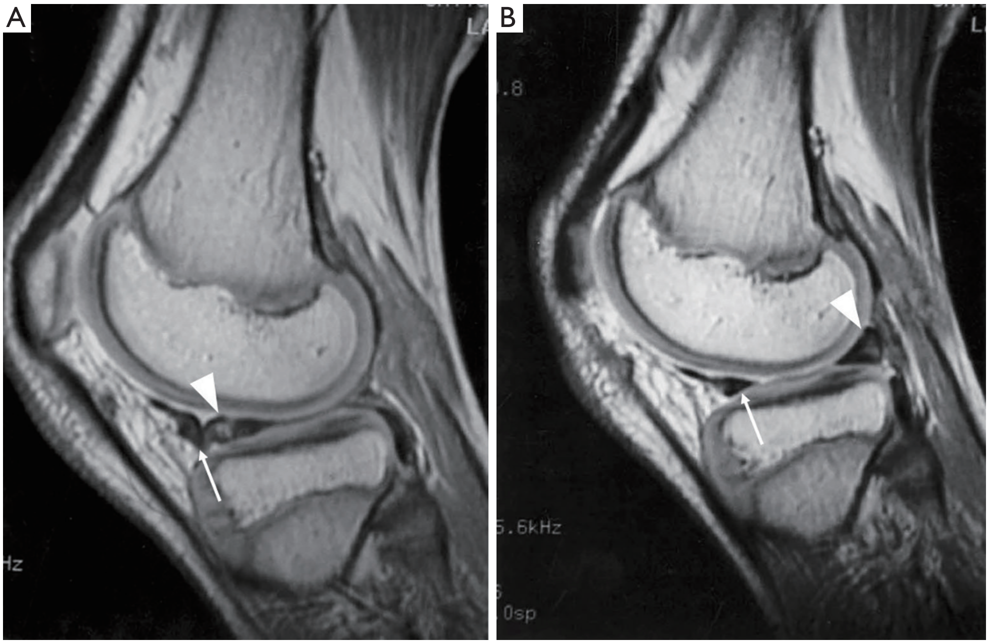

Figure 4 Sagittal MRI images, left knee, of a 12-year-old boy who is suffering from recurrent knee locking which was reproducible in hyperflexion an external rotation of the tibia. (A) MRI was taken with the knee in locked position. The posterior horn of the lateral meniscus is dislocated anteriorly. (B) MRI was taken with the knee in unlocked status. The posterior horn of the lateral meniscus is returned to his normal position. During arthroscopy, the lateral meniscus was normal in size and shaped without a tear. However, it appeared hypermobile. In A and B, the arrows show the anterior horn, while the arrowheads show the posterior horn of the lateral meniscus. [reprinted from George *et al.* (50), Copyright © 2003, with permission from Elsevier]. MRI, magnetic resonance imaging.

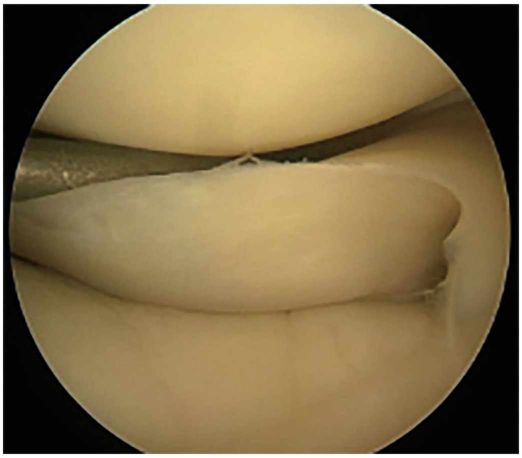

Figure 5 Arthroscopic anterior view of the lateral compartment in a left knee of a 30-year-old patient. The lateral meniscus is luxated beyond the middle of the femoral condyle and is defined as hypermobile. [reprinted by permission from Laver *et al.* (54), *Springer Nature*, Copyright © 2017].

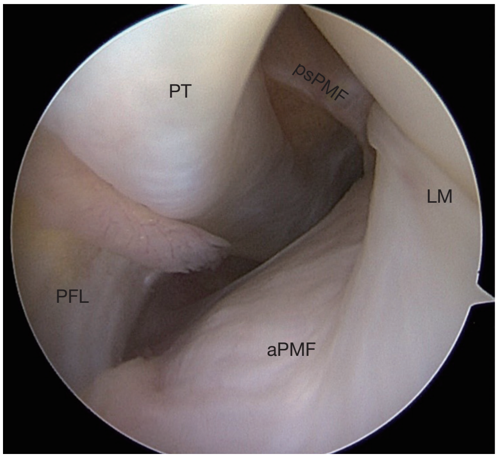

Figure 6 Arthroscopic view of the lateral gutter in a right knee with a lateral gutter drive-through sign. Notice the increased distance between the popliteus tendon and the lateral meniscus. PT, popliteus tendon; psPMF, posterosuperior popliteomeniscal fascicle; aPMF, anterior popliteomeniscal fascicle; LM, lateral meniscus; PFL, popliteofibular ligament.

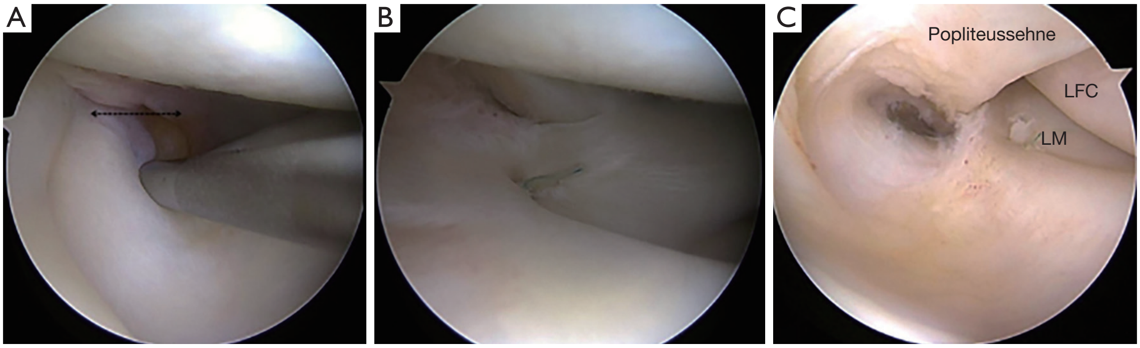

Figure 7 Arthroscopic anterior view of the lateral compartment in a right knee. (A) The popliteus hiatus is widened due to anterior popliteomeniscal rupture (arrow). During dynamic testing the lateral meniscal was defined hypermobile. (B) The lateral meniscus is stabilized with an all-inside suture of the anterior popliteomeniscal fascicle. (C) An arthroscopic view of the lateral gutter after suturing. The superior popliteal hiatus is closed, no lateral gutter drive through sign is seen. [reprinted by permission from Laver *et al.* (54), *Springer Nature*, Copyright © 2017]. LFC, lateral femoral condyle; LM, lateral meniscus; Popliteussehne, popliteus tendon.

probe or by an anterior aspiration test (9,15,45). Flexing the knee to 90° may allow to advance the arthroscope in the popliteal space, especially when widening is present due to a PMF tear, PT tear or extended posterolateral corner injury (20,55). The possibility to advance the arthroscope until the posterolateral compartment is called a "lateral gutter drive-through sign" and is found in up to 95.5% of the patients with a hypermobile LM (25,55). This allows for visualization of the posterior tibial plateau, posterior lateral femoral condyle, the posterior aspect of the LM, the menisco-capsular attachments, the posterior MTL and the piPMF. Alternatively, the posterolateral compartment can be visualized by advancing the arthroscope through the intercondylar notch.

Treatment and results

Various techniques have been described in the past including open or arthroscopic repair, thermal shrinkage and reconstruction of the PMF (6,7,11,14-18,45,49,56-59). LaPrade and Konowalchuk described an open PMF repair technique in 6 patients after the diagnosis had been made arthroscopically (15). They reported a complete resolution of symptoms at a mean follow-up of 3.8 years (15). However, they suggested that arthroscopic or arthroscopically assisted repair of the PMFs and/or the capsular attachment to the LM may also be successful. Multiple case reports or series have been published on arthroscopic repair (6,7,11,14,16-18,45,49,56,57). Higuchi *et al.* and Ohtoshi *et al.* described thermal shrinkage of the popliteal hiatus area until the LM becomes stable as a successful arthroscopic technique (56,57). However, thermal shrinkage has been abandoned in meniscal surgery and may not be the first treatment choice. In more recent literature, authors propose a repair by suturing the LM to the posterior or posterolateral capsule from an anterior view (*Figure 7*) (6,7,11,16,17,45,49,59). Simonian *et al.* was the first to report on three cases of successful arthroscopic repairs (11). They did a second look arthroscopy on one of the patients 6 weeks following initial repair due to loss of range of knee motion, showing a stable LM (11).

Steinbacher *et al.* presented the largest case series in literature of 46 knees in 45 football players (7). They performed an all-inside suture in all cases and placed the first suture just medial to the PT, suturing the LM to the posterior capsule. Consequently, they added sutures medial to the first until the LM was stabilized. In most knees [27/46] 2 sutures were performed. Although 82% returned to play, only 56% returned to the same pre-injury activity level. Three were re-operated: one patient had pain while squatting and the two others suffered from a LM tear. Similar to the repair of a ramp lesion of the medial meniscus, some authors described a repair technique through a posterolateral portal (14,18,60).

In most case series, the surgeons sutured the LM to the capsule without specific repair of the ruptured structure/s. Li *et al.* and Kamiya *et al.* did, however, repair the aPMF and/or the psPMF and/or the posterior MTL depending on which one was ruptured (49,59). Their total of 30 patients did not have recurrent mechanical symptoms after a follow-up of at least 24 months (49,59). The LM fixation on the PT is controversial (54). However, in a case series of 200 patients, Ouanezar *et al.* reported no specific complications following stabilization of LM tears using an all-inside fixation to the PT (61). Suganuma *et al.* recently proposed an additional surgical technique involving reconstruction of the a- and psPMF (58). In their surgical technique, they pulled an autologous iliotibial band graft through the periphery of the LM and fixed it on the popliteal tendon (58). Results of this technique have not yet been published.

Results of arthroscopic repair from case reports and case series are promising with overall high success rates (6,7,11,14,16-18,45,49). Furthermore, complications of arthroscopic repair were generally rare with reported complications including recurrence of mechanical symptoms, LM meniscal tear, knee stiffness and continued postoperative pain (7,11,18,56). Finally, improving the indication and optimizing the surgical technique, for example by better identification and repair of the injured structures, may further improve the results.

Summary

LMH is a challenging pathology. The diagnosis is difficult due to a lack of specific and distinctive clinical symptoms and clinical tests. Moreover, MRI has a limited sensitivity and specificity in the diagnosis of LMH as it does not allow for a dynamic evaluation. Consequently, the diagnosis of LMH is often delayed or missed. It is up to the clinician to be minded to the diagnosis, especially when assessing knees with persistent lateral related symptoms. Ultimately, the diagnosis is confirmed during knee arthroscopy, when the LM can be mobilized over 50% of the lateral tibial plateau or lateral femoral condyle using probing or aspiration. Treatment involves stabilizing the posterior menisco-capsular complex which can be achieved via an all-inside meniscal suturing technique with satisfactory outcomes and low rates of recurrence.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editors (Alberto Grassi and Stefano Zaffagnini) for the series "The Lateral Meniscus" published in *Annals of Joint*. The article has undergone external peer review.

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at https://aoj.amegroups.com/article/view/10.21037/aoj-21-9/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://aoj.amegroups.com/article/view/10.21037/aoj-21-9/coif). The series "The Lateral Meniscus" was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/aoj-21-9
Cite this article as: Beel W, Macchiarola L, Mouton C, Laver L, Seil R. The hypermobile and unstable lateral meniscus: a narrative review of the anatomy, biomechanics, diagnosis and treatment options. Ann Joint 2022;7:14.