[Orthopaedic Surgery]

Extra-articular Mimickers of Lateral Meniscal Tears

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Context: Lateral meniscus tears are a common entity seen in sports medicine. Although lateral-side knee pain is often the result of a meniscus injury, several extra-articular pathologies share signs and symptoms with a meniscus tear. It is critical for the clinician to be able to identify and understand extra-articular pathologies that can present similar to a lateral meniscus tear.

Evidence Acquisition: Data were collected through a thorough review of the literature conducted through a MEDLINE search for all relevant articles between 1980 and February 2010.

Study Type: Clinical review.

Results: Common extra-articular pathologies that can mimic lateral meniscal tears include iliotibial band syndrome, proximal tibiofibular joint instability, snapping biceps femoris or popliteus tendons, and peroneal nerve compression syndrome or neuritis. The patient history, physical examination features, and radiographic findings can be used to separate these entities from the more common intra-articular knee pathologies.

Conclusions: In treating patients who present with lateral-sided knee pain, clinicians should be able to recognize and treat extra-articular pathologies that can present in a similar fashion as lateral meniscus tears.

Keywords: meniscus injury; differential diagnosis; lateral

The arthroscopic treatment of meniscal injuries has become one of the most common orthopaedic surgical procedures in the United States, with an estimated 850 000 meniscal surgeries being performed annually.[4,22] Tears of the lateral meniscus are commonly seen in association with acute anterior cruciate ligament ruptures; however, isolated injuries often occur in a twisting injury or a hyperflexion event.[22] Patients with lateral meniscal pathology typically present with swelling, lateral joint line pain, and mechanical symptoms localizing to the lateral aspect of the knee. Lateral meniscal tears top the differential diagnosis for patients with lateral knee symptoms. However, a number of other pathologic entities may present with a similar clinical history and physical examination.

Mimickers of lateral meniscal tears include iliotibial band syndrome (ITBS), proximal tibiofibular joint instability, snapping biceps femoris or popliteus tendons, and peroneal nerve compression syndrome or neuritis. Knowledge of the subtleties of these less common sources of lateral knee symptoms can help the clinician arrive at the correct diagnosis and facilitate appropriate treatment.

ILIOTIBIAL BAND SYNDROME

ITBS is a common source of pain in athletes. Although the iliotibial band (ITB) can become inflamed proximally and present as hip pain, it most commonly presents at the lateral aspect of the knee and can mimic a lateral meniscus tear. The pain of ITBS is usually localized to the lateral femoral epicondyle, which may radiate distally to the Gerdy tubercle or proximally along the tensor fascia lata. ITBS is the most common cause of lateral knee pain in athletes, with an incidence as high as 12% of all running-related overuse injuries.[5,18] The ITB is a continuation of the tendinous portion of the tensor fascia lata muscle, with some contribution from the gluteal muscles. The ITB is connected to the linea aspera via the intermuscular septum until just proximal to the lateral epicondyle of the femur.[47] As the ITB extends distally, it spans out and inserts on the lateral border of the patella, the lateral retinaculum, and the Gerdy tubercle. The ITB is free from bony attachment between the superior aspect of the lateral femoral epicondyle and the Gerdy tubercle.[18,32] ITBS is caused by excessive friction of the distal ITB (and/or

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No potential conflict of interest declared.
DOI: 10.1177/1941738110385997

associated bursa) as it slides over the lateral femoral epicondyle during repetitive flexion and extension of the knee, resulting in symptomatic irritation.[27]

Patients with ITBS typically report the insidious onset of lateral knee pain with activity—particularly, running and cycling (and other activities requiring repeated flexion-extension cycles of the knee). They initially present with diffuse pain and will often use the palm of the hand to indicate pain throughout the lateral knee. With progressive inflammation, such pain will often localize 2 to 4 cm proximal to the lateral joint line.[18,27] Patients often note worsening of pain with activity on inclined surfaces—notably, downhill running. This occurs because the posterior fibers of the ITB contact the lateral femoral epicondyle at approximately 20° to 30° of knee flexion.[17,39] During downhill running, the knee flexion angle at foot strike is reduced, placing the ITB in more frequent contact with the lateral epicondyle.[39] Sprinters are less likely to get ITBS due to the knee being flexed to a higher degree at foot strike. The pain typically begins several minutes into a run or after the completion of a run. With continued activity and no treatment, constant pain can result, even at rest.[27]

Physical examination findings may include a stiff-legged gait on the affected side as the patient attempts to avoid flexion, although most patients will walk normally. On palpation, there may be tenderness over the lateral femoral epicondyle. Pain can be reproduced by single-leg stance with the knee flexed to 30°.[16,40] A positive Ober test result may demonstrate ITB tightness (Figure 1). The Ober test is performed with the patient lying on his or her unaffected side and with the unaffected hip and knee at 90° angles. Inability to adduct the affected extremity past the midline is indicative of ITB tightness. Runners with ITBS may have leg-length discrepancies (syndrome develops in the shorter leg), forefoot varus, or high knee Q angles compared with controls.[39]

Imaging studies are frequently required in the workup of ITBS to rule out other potential causes of pathology. A case of synovial cell sarcoma presenting as ITBS has been reported,[34] and patients with ITBS with osteochondromas of the lateral supracondylar region are known. Persistent night pain, pain at rest, or suspicion of additional joint pathology mandates further assessment with radiographic evaluation. Plain radiographs can assess arthritis, fracture, or tumor. Magnetic resonance imaging (MRI) evaluation may confirm a specific clinical question; it can also be useful for surgical planning. Typical MRI findings with ITBS include thickening of the ITB over the lateral femoral condyle and fluid collection deep to the ITB.[14]

Treatment of ITBS is typically divided into the following phases: acute, subacute, recovery strengthening, and return to activity. During the acute phase, the offending activity should be avoided and local inflammation[18] reduced with oral nonsteroidal anti-inflammatory medications and physical therapy modalities, including ice, massage, phonophoresis, and iontophoresis. Corticosteroid injections are recommended as a means to progress to rehabilitation for patients with severe pain or swelling.[23] The corticosteroid injection should be given in the area where the ITB crosses the lateral femoral condyle; it usually consists of 40 mg of methylprednisolone acetate mixed with a short-acting local anesthetic to provide diagnostic and therapeutic benefits. Once the acute inflammation has diminished, stretching exercises are initiated. The goal of the subacute phase is to address biomechanical abnormalities and

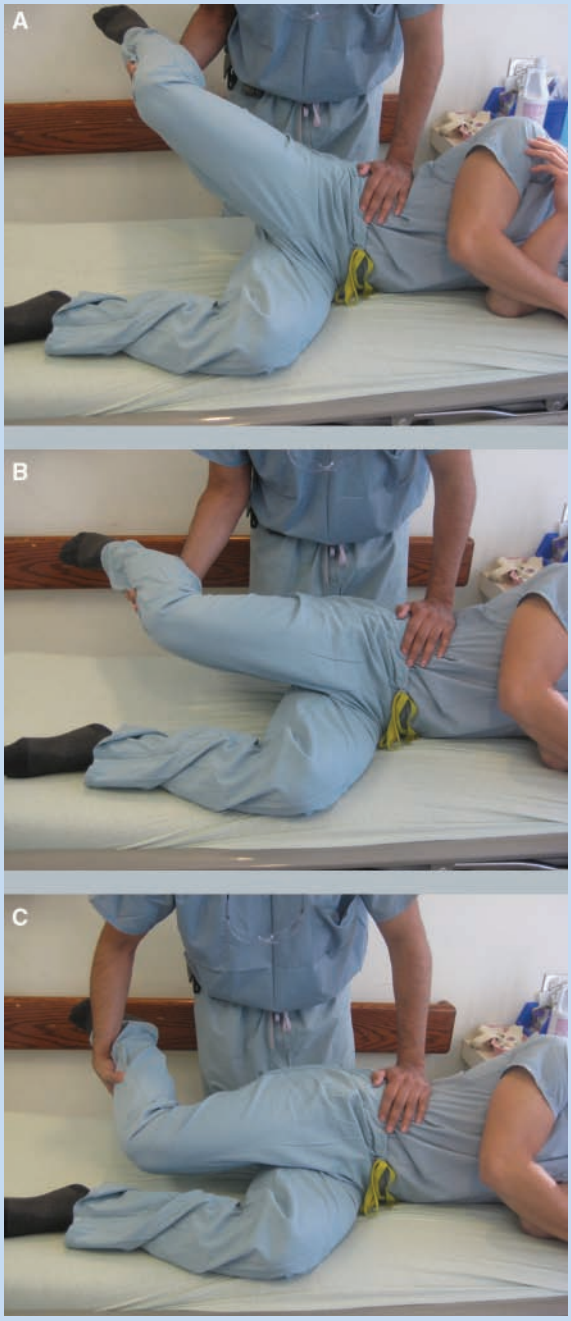

Figure 1. Ober test for iliotibial band tightness: A, positioning before release; B, positive test result indicating iliotibial band tightness; C, negative test result indicating normal iliotibial band laxity.

tightness in the ITB, hamstring, gluteal, and adductor muscle groups. Strengthening can begin once range of motion and myofascial restrictions have been resolved.[17] The major focus during the strengthening phase is to target the hip abductors.[16] Return to activity usually occurs by 6 weeks, when the patient can perform open and closed chain strengthening exercises with proper form and without pain.[17] Surgical intervention is not recommended unless conservative treatment options have been exhausted, normally after 6 months of nonoperative treatment. The most common procedures involve resecting a triangular piece of the ITB from the area overlying the lateral epicondyle when the knee is in a 30° flexed position[32,42] Another surgical approach is to incise a portion of the posterior aspect of the ITB (partial surgical release) where it contacts the femoral epicondyle. The goal of these surgical procedures is to reduce tension in the ITB and minimize contact with the epicondyle. Although there are few case series of surgical management, Drogset et al reported a retrospective series of 45 patients who underwent partial surgical release of the ITB with 84% good to excellent results.[12] In general, surgical treatment for ITBS is extremely uncommon.

PROXIMAL TIBIOFIBULAR JOINT INSTABILITY

The proximal tibiofibular joint is a synovial membrane-lined hyaline cartilage articulation that is stabilized by anterior and posterior ligamentous attachments.[13,35,41] Proximal tibiofibular joint instability is a rare entity that has signs and symptoms that can be confused with lateral meniscus tears as well as posterolateral instability. There is wide variation in pathology—from idiopathic subluxation to an acute traumatic dislocation. Two anatomic variants of the proximal tibiofibular joint have been described.[35,38] The oblique variant is defined by an angle of inclination of the proximal tibiofibular joint of greater than 20° relative to the horizontal plane; the horizontal variant has less than 20° inclination. The fibular head is seated in a groove behind a prominent lateral tibial ridge, which enhances its stability against anterior dislocation.[35,36,38] Instability patterns have been described as atraumatic subluxation, anterolateral dislocation, posteromedial dislocation, and the rare superior dislocation (Figure 2).[1,3]

Patients with atraumatic subluxation of the proximal tibiofibular joint often have a history of generalized ligamentous laxity, muscular dystrophy, or Ehlers-Danlos syndrome.[35,37,38,43,44] As in other hypermobility entities, the condition is often bilateral, more common in females, and symptoms decrease with skeletal maturity.[37,38,43,44] Patients usually have lateral pain that increases with direct pressure over the fibular head. The clinical presentation of patients with acute dislocations is more variable; typical symptoms include pain with ankle motion, swelling over the lateral aspect of the knee, and inability to bear weight.[15,30,48-50] Peroneal nerve symptoms are most common with posteromedial tibiofibular dislocation.[10,35,38,43] Patients may lack terminal knee extension and may have painful knee motion.[49,50] Chronic dislocation of the proximal tibiofibular joint closely mimics lateral meniscus injury, with complaints of lateral knee popping, clicking, and catching.[15,45,48,49] A history of symptoms worsening with twisting motions further suggests lateral meniscus tears.[21]

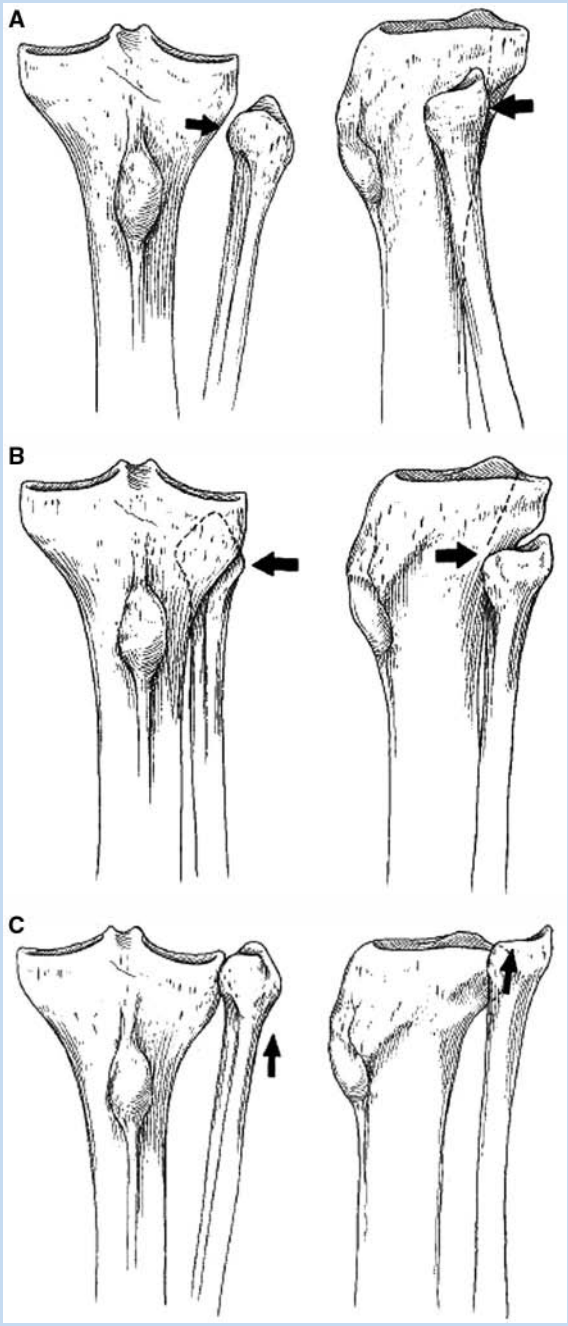

Figure 2. Types of proximal tibiofibular joint dislocation (arrows): A, anterolateral dislocation; B, posteromedial dislocation; C, superior dislocation.
Adapted from Sekiya J, Kuhn J. Instability of the proximal tibiofibular joint. *J Am Acad Orthop Surg.* 2003;11(2):120-128.

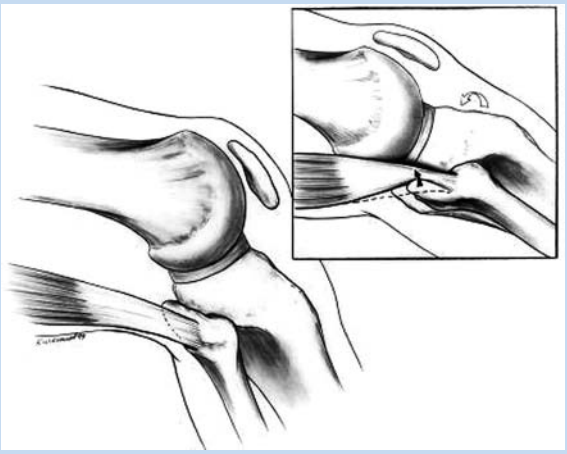

Figure 3. The Radulescu test is performed with the patient prone, with one hand stabilizing the thigh, and with the knee flexed to 90°. The leg is rotated internally in an attempt to subluxate the fibula anteriorly.

In chronic injuries or patients with atraumatic subluxation, a focused proximal fibula examination is vital. It is critical to compare the opposite unaffected knee because there is often variability in joint translations. For this test, the knee should be flexed to 90° to relax both the lateral collateral ligament and the biceps femoris tendon. The proximal fibula should be translated anteriorly and posteriorly while assessing apprehension and motion.[43,46] The Radulescu test is performed with the patient prone, with one hand stabilizing the thigh, and with the knee flexed to 90°. The leg is internally rotated in an attempt to subluxate the fibula anteriorly (Figure 3).[3] The proximal tibiofibular joint is usually stable with the knee in full extension unless a posterolateral corner injury is present. Acute traumatic tibiofibular joint dislocation usually presents with a lateral mass and severe proximal pain, especially with dorsiflexion and eversion of the foot.[38] With an anterolateral dislocation, the stretched biceps femoris tendon may appear as a tense cord, aiding in the diagnosis.[38] The functional status of the peroneal nerve should be documented with tibiofibular dislocations.

Radiographic evaluation of the proximal tibiofibular joint should consist of true anterior-posterior and lateral views of both knees. The fibula head should overlie the posterior border of the tibia on the lateral view.[41] Resnick et al identified a line on lateral radiographs that follows the lateral tibial spine distally along the posterior aspect of the tibia and defines the most posteromedial portion of the lateral tibial condyle (Figure 4).[41] The middle third of the fibula head should be over this line. With posteromedial dislocations, the majority of the fibula head is posterior to this line, whereas with anterolateral dislocations, the fibula head will be anterior. The most accurate radiographic modality is axial computed tomography, which should be performed if radiographs do not clarify the diagnosis.[26]

Figure 4. The line on this lateral radiograph of the knee follows the lateral tibial spine distally along the posterior aspect of the tibia. The middle third of the fibula should be localized over this line.

Treatment of proximal tibiofibular instability varies with the pathology and chronicity of symptoms. Atraumatic subluxations can typically be managed nonsurgically with a supportive strap or bandage placed 1 cm below the fibular head.[24] Physical therapy, nonsteroidal anti-inflammatory medications, and limitation of activities that evoke pain should result in resolution of symptoms. With acute dislocation, a closed reduction should be performed by placing the knee in flexion (80° to 110°) and applying force to the fibula head.[38,49] Immobilization after a closed reduction is controversial.[15,37,48-50] Open reduction should be performed if closed reduction fails.[1,9,43,49] After open reduction, fixation may be needed as well as primary repair of the anterior and posterior tibiofibular ligaments. Hardware should be removed after 6 to 12 weeks, similar to a syndesmosis injury of the ankle.[1,49] With recurrent dislocations or malreductions, treatment is dictated by the condition of the articular surface of the joint. If there is severe degeneration, arthrodesis and fibular head resection are options.[37,38] For arthrodesis, resecting 1.5 cm of the fibula at the junction of the proximal and middle thirds of the fibula is needed for motion of the fibula at the ankle joint.[1,38]

A complication after fibular head resection can be lateral knee instability.[11] For patients with instability or malreduction without significant degeneration of the tibiofibular joint, reconstruction of the supporting structures can be performed[43] using a portion of the biceps femoris attached to the fibula head and routed into the posterior aspect of the tibia.[21]

SNAPPING BICEPS FEMORIS AND POPLITEUS TENDONS

Lateral pain may also occur secondary to biceps femoris or popliteus tendon snapping. The biceps femoris has a long head originating from the ischial tuberosity and a short head taking origin from the linea aspera and the lateral aspect of the supracondylar femur.[19] The tendons unite and insert onto the posterolateral portion of the fibular head. Anomalies in the tendon's insertion onto the fibula or an abnormal fibular head prominence can result in snapping of the biceps femoris during motion. Kristensen et al described a symptomatic snapping biceps femoris in a 20-year-old football player with 2 years of activity-related lateral knee pain.[28] At the time of surgery, an abnormal anterior insertion on the fibular head was found. Fibular head resection resolved the snapping tendon and associated knee pain. Similar cases of symptomatic snapping biceps femoris secondary to abnormal tendinous insertions have been described.[24,29] Another variant leading to symptomatic snapping is biceps tendon insertion on the anterolateral proximal tibia without attachment to the fibular head.[24] Painful snapping of the biceps femoris tendon can occur with fibular head enlargement. A case report of a snapping biceps femoris tendon in a 24-year-old amateur soccer player with a prominent fibular head resolved following a partial fibular head resection.[2] Bilateral snapping biceps femoris tendons in a 17-year-old cyclist with fibular head exostoses resolved with bilateral exostectomy (Figure 5).[19] Sequential examination under anesthesia with extension of the hyperflexed, internally rotated knee is used to determine the amount of resection needed. Occasionally, preoperative MRI or direct intraoperative visualization will demonstrate an anomalous band of the biceps femoris inserting on the tibial plateau.

Similarly, lateral-side knee pain can occur secondary to a snapping popliteus tendon. The popliteus musculotendinous complex provides static and dynamic stabilization to the posterolateral knee.[7,31] In extension, the popliteus lies in the incisura poplitea extensoria, a small indentation on the lateral femoral condyle.[8] Posterior to this incisura, a lateral extension of the femoral condyle creates the sulcus popliteus between the lateral condyle and epicondyle. During knee flexion, the popliteus tendon rides over the femoral condyle to the sulcus.[8] Abnormalities of the bony anatomy or traumatic changes in the tendon can create a painful snap with translation. Diagnosis of a snapping popliteus tendon syndrome is difficult. The Cabot test[31] is performed in the supine position with the affected knee flexed and with the lower leg crossed over the extended contralateral leg (Figure 6). With palpation of the lateral joint line, the patient actively extends the affected knee. A painful snap during this maneuver is consistent with the diagnosis. Popliteal tendon snapping may also be produced by applying a varus stress to the knee during passive flexion and extension cycling.[7] Six patients with symptomatic snapping popliteus tendon syndrome have been reported: 3 from trauma, 2 arising spontaneously, and 1 following an OATS (osteoarticular transfer system) procedure on the lateral femoral condyle.[7] Four patients were managed nonoperatively, with rest and physical therapy. Two patients with persistent symptoms had a popliteus tendon release and 1, a tenodesis to the lateral collateral ligament resulting in complete symptom relief. Three cases of symptomatic popliteus tendon impingement on a posterior osteophyte were successfully managed with arthroscopic osteophyte excision or tendon release.[20]

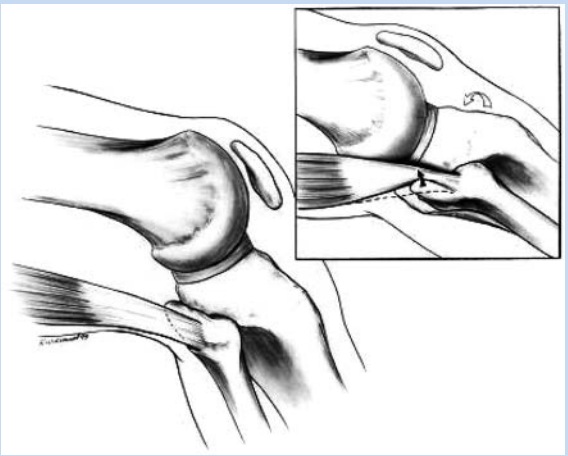

Figure 5. Mechanism of subluxations of the biceps femoris tendon over the fibular head.
Adapted from Bach, Jr, BR, Minihane K. Subluxating biceps femoris tendon: an unusual case of lateral knee pain in a soccer athlete. *Am J Sports Med.* 2001;29(1):93-95.

PERONEAL NERVE COMPRESSION/ NEURITIS

Pain in the lateral aspect of the knee may be the result of a compressive neuropathy or neuritis of the common peroneal nerve.[6,25,33] Focal knee pain over the fibular head or distal symptoms may be present in the distribution of the peroneal nerve. Common peroneal nerve compression, injury, or neuritis may produce a positive Tinel sign at the fibular neck; weakness of ankle dorsiflexors, evertors, or toe extensors; sensory changes in the superficial and deep peroneal nerve distributions; or gait changes. The superficial branch supplies the foot evertors and sensation to the skin of the lateral calf and dorsum of the foot. The deep peroneal branch supplies the foot and toe dorsiflexors and has a small sensory component, which innervates only the skin of the web space between the first and second toes.

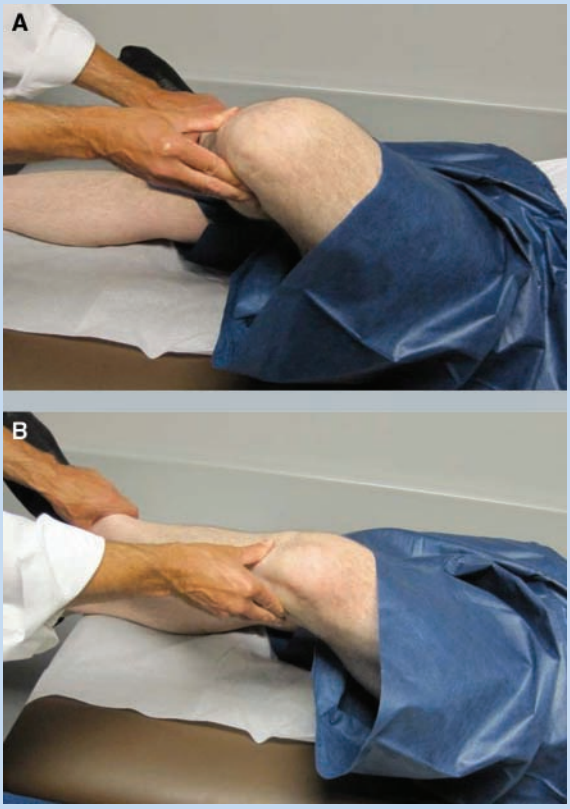

Figure 6. Cabot test. A, patient is in the supine position with the affected knee flexed and with the lower leg crossed over the extended contralateral leg; B, the patient actively extends the knee while the examiner palpates the lateral joint line. A painful snap indicates a positive test result.

Peroneal nerve symptoms may develop with the following: direct trauma to the lateral aspect of the knee, increased lower leg musculature (which can lead to compression of the nerve against adjacent fibrous/fascial layers), exertional compartment syndrome, stretch injury from forceful plantar flexion or inversion of the ankle at its penetration of the peroneus longus, excessive or rapid weight loss, and habitual leg crossing or prolonged pressure.[6,25,33] Excessive or rapid weight loss can lead to thinning of the fat pad overlying the fibular head, predisposing the patient to nerve injury from external compression.

Imaging may identify osseous lesions in the region of the proximal fibula, including fractures or tumors. MRI may demonstrate compressive soft tissue pathology or edema around or within the nerve. An electromyogram and nerve conduction study of the extensor digitorum brevis may delineate the location of the compressive lesion.[25] If the lesion is at the knee, then conduction block may be present or, more commonly, conduction velocity slowing over that segment of the nerve. Electromyograms are useful to localize the lesion, and they may determine which nerve is primarily involved: the common peroneal nerve at the knee or 1 of its 2 branches, the superficial or deep peroneal nerve. Electromyograms can also distinguish a lumbar radiculopathy from a focal problem in the lower extremity.

Treatment of a peroneal nerve compression or neuritis initially consists of rest and avoidance of any offending activities. In the acute setting, immobilization of the ankle in neutral dorsiflexion, ultrasound, heat, and iontophoresis can be effective early interventions.[6,33] In an acute palsy, an initial electromyogram soon after the injury[6,33] and/or a repeat study at 3 months may be indicated. Surgical decompression and neurolysis is typically reserved for cases in which conservative management fails to improve symptoms in 4 to 6 months.

SUMMARY

Lateral meniscal pathology, ITBS, proximal tibiofibular instability, snapping biceps femoris and popliteus tendons, and peroneal nerve compression or neuritis can present with similar physical examination findings. Knowledge of these extra-articular mimickers of lateral meniscal tears can enable the clinician to arrive at the correct diagnosis and provide appropriate treatments.

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