Isolated Rupture of the Popliteus Muscle with Painful Ossification in a Skeletally Immature Athlete

A Case Report

Michael J. Sileo, M.D., and Michael C. Schwartz, M.D.

Abstract

A case of an isolated popliteus tendon rupture occurring during sport in a skeletally immature athlete is presented. Treatment is not always clearly defined, as both nonoperative and operative have been successful. Because the outcome of rest from sports activity and failed trials of physical therapy allowed continued discomfort in the posterolateral aspect of the knee in this patient, repeat imaging and arthroscopy were performed. Part of the popliteus tendon was demonstrated to have ossified and was openly debrided. The remaining tendon was repaired to the lateral capsule. The patient went on to a full recovery and return to sport.

Isolated rupture of the popliteus tendon is rare. Injury to the popliteus musculotendinous unit is more commonly associated with trauma to the posterolateral ligamentous complex of the knee. There is no consensus as to the management of isolated injuries of the popliteus tendon. Support in the literature exists for successful treatment with operative[1-6] and nonoperative treatments.[7-11] We present a case of a skeletally immature athlete with an isolated popliteus tendon rupture in which several trials of physical therapy failed to improve the patient's symptoms and he presented with persistent pain in the posterolateral aspect of the knee.

Case Report

A 15-year-old male football player, 5 feet, 3 inches in height and 110 pounds, presented 4 months after injuring his left knee during a game. The patient stated that another player had rolled onto his left knee from behind. He did recall hearing a "pop" and sensing an almost immediate effusion. He was seen initially at a local emergency room, where the effusion was drained. After orthopaedic evaluation and magnetic resonance imaging (MRI) were performed at an outside institution, he was diagnosed with a medial meniscal tear and strain of the popliteus tendon.

When the patient first presented for assessment at our institution, his chief complaint was subjective instability as well as discomfort along the posterior aspect of the knee. Physical examination revealed full extension ability but not hyperextension; flexion to 110° with discomfort was possible, and a minimal effusion was present. The knee was stable to varus and valgus stress testing at both 0° and 30°. Lachman and posterior drawer tests were negative. Joint line tenderness was observed, more so on the posterolateral than medial side of the knee. The dial test for rotation was symmetric at both 30° and 90° of knee flexion. Review of the previously performed MRI revealed grade I signal change in the medial meniscus and marked thickening within the intrasubstance of the popliteus tendon. There was no evidence of a lateral meniscal tear. Evidence of a bone contusion of the posterior lateral femoral condyle and midportion of the lateral tibial plateau was present. A repeat MRI was obtained specifically to search for a chondral or meniscal injury not seen on the previous studies. This MRI was performed approximately 6 months from the time of initial injury (Figs. 1 and 2). The study revealed an avulsion injury to the insertion of the popliteus tendon, with dystrophic ossification along the distal tendon. There was increased signal in the substance of the medial meniscus but no evidence of a lateral meniscal tear or chondral defect.

At this point, the patient had already failed two trials of physical therapy, and relative rest over the winter sports season had failed to resolve his symptoms. He continued to experience pain and tenderness on palpation along the

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Figure 1 The left knee demonstrates calcific changes along the length of the popliteus tendon on the AP radiograph.

posterolateral joint line during physical examination. After extensive discussion with the patient and his family regarding the potential risks and benefits of surgical intervention, it was decided to undergo diagnostic arthroscopy and open debridement of the popliteus tendon.

On examination under anesthesia, the Lachman, posterior drawer, varus, and valgus stress testing were all normal. The dial test was symmetric at 30° and 90° of knee flexion (Fig. 3A). The popliteal insertion at the lateral femoral condyle was found to be palpable and calcified in nature. On diagnostic arthroscopy, moderate inflammation of the synovial tissue was noted around the popliteus tendon, which felt calcified on examination by a probe. After arthroscopy was performed, the knee was flexed to 90°, and the interval was developed between the iliotibial band and the biceps femoris. The lateral collateral ligament (LCL) was identified and retracted posteriorly, and the popliteal tendon was identified at its femoral insertion. There were no remaining fibers connecting the calcified bulbous tendon to the femoral epicondyle. The abnormal bulbous and calcified tendon was sharply excised, and the remaining normal appearing tendon was repaired to the underlying lateral capsular tissue (Figs. 3B-D).

Postoperatively, the patient was allowed to weight bear as tolerated, and no restriction was placed on range of motion of the knee after the surgical incision had healed. Histologic examination of the excised specimen was consistent with degenerated tendon with reactive and degenerative changes. At the most recent follow-up, 6 months after surgical intervention, the patient returned to all sporting activities. His posterolateral knee pain has resolved and his knee has full range of motion with no evidence of ligamentous instability.

Discussion

The popliteus musculotendinous unit is exceptional in that its tendinous proximal attachment is designated the origin and its distal muscular attachment (tibial side) is designated the insertion.[12] The popliteus tendon courses through the popliteus hiatus, where it enters the knee joint and inserts onto the lateral femoral condyle at the end of the popliteal sulcus. There are variable aponeurotic attachments to the posterior horn of the lateral meniscus and fibular head.[6,13,14] The popliteus tendon is easily visualized arthroscopically, and is covered by a thin layer of synovial membrane in the knee joint. The insertion into the lateral meniscus theoretically allows for retraction of its posterior horn during knee flexion; thus, protecting the meniscus from the femoral condyle.[15]

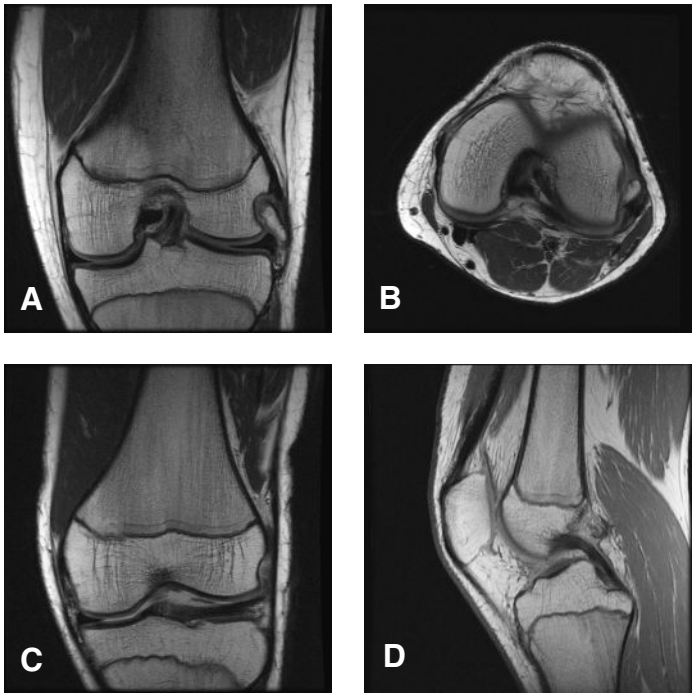

Figure 2 **A**, Calcific popliteus tendon with a lack of continuity at its insertion onto the femur. **B**, Calcified popliteus tendon with a lack of continuity on axial image. **C**, Intact LCL. **D**, Intact posterior cruciate ligament.

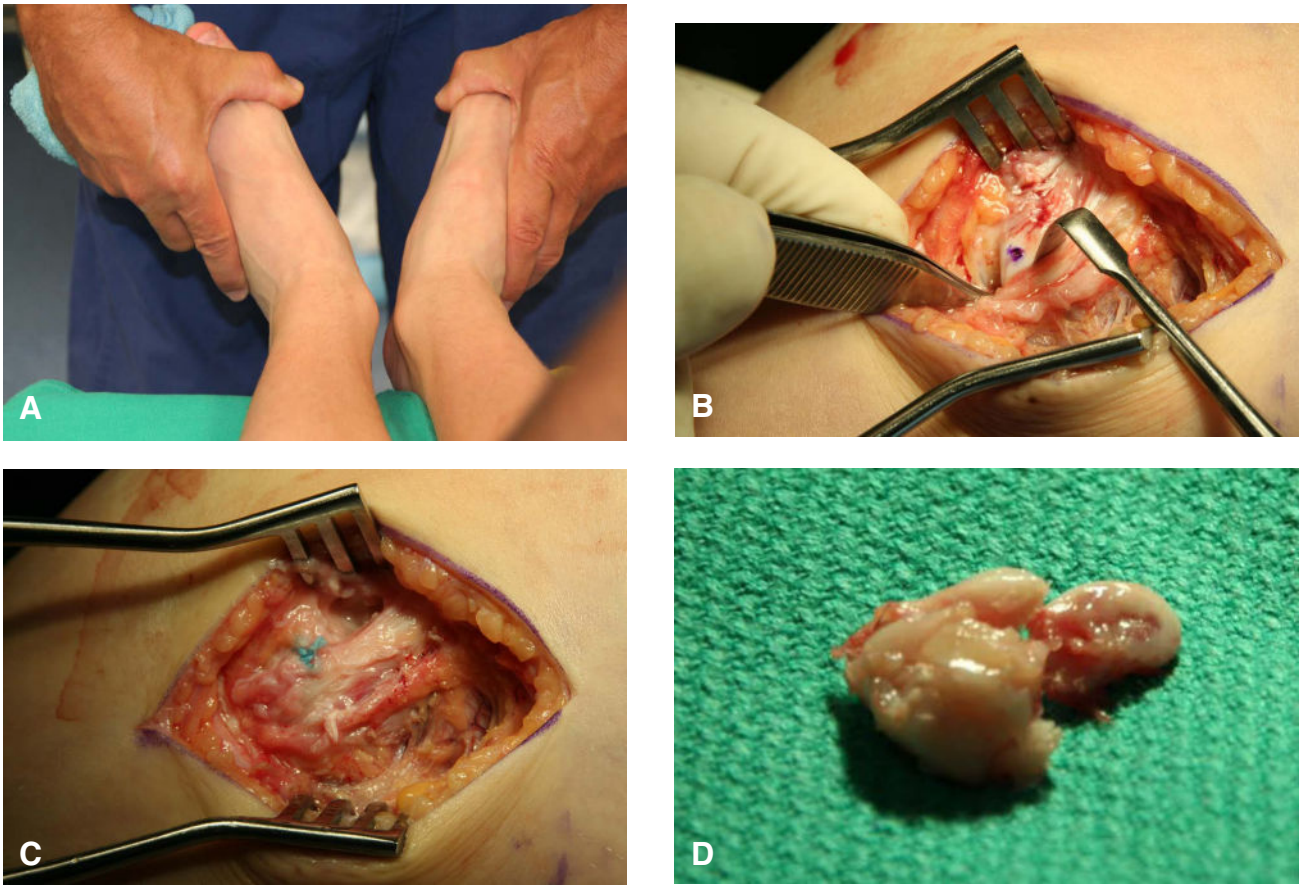

Figure 3 **A**, Symmetric dial test. **B**, LCL is retracted, with popliteus identified (dot in center of photograph). **C**, Remaining popliteus tendon is reefed to lateral capsule. **D**, Resected calcified popliteus tendon.

The popliteus muscle functions as a concentric internal rotator of the tibia on the femur during open chain movements and eccentrically during closed chain movements as the femur externally rotates on the tibia. It is unique in that it is the only muscle that has sufficient mechanical advantage to produce internal rotation of the tibia on the femur during gait.[16] The popliteus may also assist the posterior cruciate ligament in preventing forward displacement of the femur during deceleration moments as well as help stabilize the posterior capsule of the knee joint. In our case, stability of the knee, including the posterolateral complex, was maintained by the remaining intact posterolateral structures and cruciate ligaments.

Lateral pain associated with an acute hemarthrosis and a stable knee should lead to suspicion of an isolated popliteus tendon injury.[4] An acutely swollen knee with posterolateral tenderness and exacerbated pain on resisted internal tibial rotation may also be present. Examination techniques have been described, the key component of which is to reproduce pain by either passive external rotation or resisted internal rotation of the knee. The Garrick test involves testing the popliteus with the patient supine and hips and knees flexed at 90°.[17] Resisted internal rotation or, alternatively, passive external rotation of the knee provokes pain posterolaterally at the popliteus. However, this test has yet to be proven reliable and reproducible. The best way to examine the popliteus tendon is with the patient prone and palpating the posterior joint line medial to the biceps femoris.[18] Other tests, including the external rotation recurvatum test, the varus stress test (at 0° and 30° flexion), the reverse pivot shift test, the dial test, and the posterolateral drawer test, are described for posterolateral corner of the knee injuries and are not truly specific to the popliteus.

When clinical examination warrants, MRI of the knee may be performed to evaluate further a suspected injury to the popliteus musculotendinous unit. While the actual incidence is unknown, injury to the popliteus is typically found in conjunction with posterolateral corner injuries. Some investigators have estimated that fewer than 10% of all popliteus injuries are isolated.[19,20] However, in an MRI survey of over 2412 knees, 24 popliteus injuries were found, and only two of these cases were isolated injuries to the popliteus.[19] While standard MRI knee protocol with fat suppression and high contrast images can identify these injuries, some investigators have suggested that the posterolateral corner of the knee is best visualized with coronal oblique images in the plane of the popliteus tendon.[20]

Surgical reconstruction is commonly necessary to prevent posterolateral instability in patients who sustain a rupture of the popliteus in association with injury to other lateral and

posterolateral ligamentous structures of the knee.[21] The type of surgery to be performed greatly depends on the chronicity of the injury. Acute injuries (fewer than 3 weeks since occurrence) are best treated by direct repair. Chronic posterolateral corner injuries commonly require reconstruction; however, surgical reconstruction is not without complications due to the complex anatomy of the posterolateral corner of the knee.

The recommended treatment for isolated popliteus tendon ruptures is poorly defined. Good results have been obtained with both operative and nonoperative treatment.[1-5,7-9,11,12,22] Review of the literature reveals that with isolated popliteus injury the knee is stable or opens only slightly with varus stress testing. Operative treatment has been successful when the popliteus tendon rupture was associated with an osteochondral fragment that could be reattached.[4] Partial popliteus tendon tears have also been successfully treated with surgical repair. One reported case of operative treatment with arthroscopic debridement utilizing a power shaver relieved mechanical impingement due to isolated rupture of the popliteus tendon.[1] Nonoperative treatment consisting of ice, rest, and range of motion exercises has also been successful. Two cases of isolated popliteus injury with neurologic deficit have been reported.[10,23] Both involved decreased plantar sensation and weakness of the toe flexors, and conservative treatment was undertaken in both patients. In one case, neurologic findings resolved at 24 weeks. In the other, there was residual numbness on the plantar aspect of the foot and 80% strength of the toe flexors 2 years after injury. In neither case did the popliteus injury result in instability or discomfort of the knee.

In conclusion, we described a case of isolated rupture of the popliteus tendon in a skeletally immature athlete while playing football. Initial treatment with rest, ice, and physical therapy failed to resolve the patient's symptoms of pain and discomfort over the posterolateral knee. Radiologic studies revealed extensive calcification along the course of the ruptured popliteus tendon. He was successfully treated with diagnostic arthroscopy and open debridement of the calcified tendon. The remaining normal tendon was repaired to the lateral knee capsule. At 6-months follow-up, this athlete's pain was resolved and examination of the knee revealed no evidence of ligamentous laxity. The patient had a full recovery and resumed his normal level of sports activity.

Acknowledgment

Informed written consent for the electronic and written publication of this case report was obtained from the patient's guardian.

Disclosure Statement

Neither author has a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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