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CASE REPORT

Isolated popliteus tendon injury in a young patient: A case report

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ABSTRACT

Isolated popliteus injury is a rare clinical condition which can be treated either surgically or conservatively. Factors such as the patient's age, activity level, and cooperation with the medical team are determinants to choose the most optimal treatment option. A 29-year-old female patient presented with a knee injury caused by a low-speed motorcycle accident. Further examination suggested an isolated popliteus injury without any concomitant knee injury. We opted for surgical treatment, as it allowed us to act more confidently in the postoperative follow-up and the patient did not inspire confidence in the medical team in terms of close follow-up and compliance with the physical therapy protocols that would be required, if conservative treatment was chosen. In conclusion, isolated popliteus injury is a rare condition with no consensus on the treatment algorithm. Both surgical and conservative treatments can yield good to excellent results. Surgical treatment may be considered in selected cases where an optimal close follow-up regimen seems to be unlikely.

Keywords: Isolated popliteus injury, popliteus tendon; surgical treatment.

An injury which only affects the popliteal tendon (PT) is a rare occurrence, as this tendon is part of the posterolateral corner (PLC) of the knee joint. The PT is one of three critical components of the PLC. If a PLC injury occurs, it is typical for other components of the PLC and/or the cruciate ligaments to also be injured.[1]

The PLC of the knee joint is composed of several structures, including the iliotibial band, biceps femoris muscle, popliteus muscle consisting of the popliteofibular ligament and popliteomeniscal fascicles, fabellofibular ligament, arcuate ligament, lateral gastrocnemius, and lateral collateral ligament.[2] The popliteal muscle, which consist of anterior and posterior fibers and originates from the posteromedial aspect of the proximal tibia, continues as an extra-articular but intracapsular structure. It passes through the popliteal hiatus and attaches to the lateral aspect of the femoral condyle. Although the isolated injury of this structure does not seem to cause instability, popliteus is the most significant part of PLC to prevent external rotation of tibia, and it is the primary internal rotator of tibia in non-weight-bearing status. It is a both static and active restraint for tibial external rotation. Popliteus functions both in closed and open chain phase of gait cycle and assists in knee flexion. It internally rotates the tibia in non-weight-bearing status. Popliteus referred as key to unlock the knee, that is due to the contraction of popliteus on weight-bearing flexed knee, causing flexion and lateral rotation of the femur on the tibia.[1]

The incidence of isolated injuries to the PLC is relatively rare, and an isolated injury to the popliteus tendon is even rarer. Many orthopedic surgeons have a limited understanding of the complex anatomy and function of the PLC. The complexity and variability of the numerous structures in the PLC, as well as the limitations of imaging techniques, can make

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it difficult to fully comprehend this complex. This limited understanding of the anatomy and function of the PLC can lead to difficulty in diagnosing and treating such injuries.[2]

In this article, we present a female patient who had an isolated PT avulsion injury from its femoral insertion following a motorcycle accident and was successfully treated with surgery.

CASE REPORT

A 29-year-old female patient was admitted to the emergency department after sustaining a knee injury in a motorcycle accident. During the accident, the patient fell from her motorcycle while accelerating slowly. She hit her flexed knee on the ground first and, then, her leg became trapped under the motorcycle. Following the accident, the patient experienced severe pain on the lateral side of her right knee and was unable to bear weight or walk.

Upon her physical examination, the patient's right knee was observed to be swollen with significant tenderness on the lateral femoral condyle. The range of motion (ROM) of her right knee was restricted by 10 degrees in both flexion and extension compared to her left knee. There was no varus-valgus instability in both extension and 30-degree flexion. During the Lachman test, a firm endpoint was observed with no detectable translation, while the anterior and posterior drawer tests were negative. Unfortunately, the pivot shift test could not be performed due to the patient's pain level. However, the dial test was conducted at both 30 and 90 degrees of flexion, suggesting that the patient's posterior cruciate ligament and PLC were intact.

Upon reviewing the radiographs, a cortical irregularity (Figure 1) was noted, leading us to suspect an avulsion injury. To confirm the diagnosis and rule out any potential bony injuries, a computed tomography (CT) scan was performed which revealed the presence of a bony fragment on the lateral side of the lateral femoral condyle (Figure 2). This fragment was found to be located at the site compatible with the popliteus femoral insertion. Subsequently, a magnetic resonance imaging (MRI) was performed, which confirmed our initial findings and indicated that the patient had sustained an isolated popliteus avulsion injury. Minimal effusion was observed in the joint (Figure 3), and other components of the PLC, cruciate ligaments, and medial structures were found to be intact. In addition, minimal degeneration of the posterior horn of the lateral meniscus was also noted on MRI.

The patient reported high clinical expectations and raised concerns about working in close collaboration with the medical team in case of non-operative treatment, which would require extended observation. Although both surgical and non-operative treatments

FIGURE 1. Anteroposterior view of knee. Arrow depicting cortical irregularity on lateral femoral condyle.

FIGURE 2. Coronal slice of knee computed tomography. Arrow depicting popliteal avulsion from its femoral insertion.

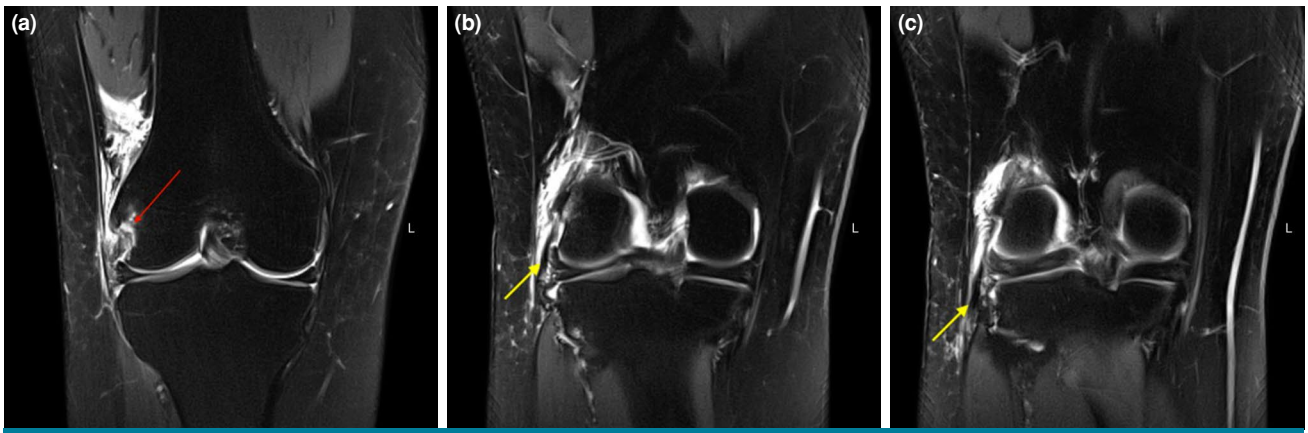

FIGURE 3. Coronal slices of right knee magnetic resonance imaging. **(a)** Red arrow depicting popliteus avulsion injury, yellow arrows in **(b)** and **(c)** indicates lateral collateral ligament continuity.

have been reported in the literature with favorable outcomes, in this particular case, we decided to pursue the surgical option.

Under general anesthesia, a secondary examination was conducted, which confirmed the initial assessment and indicated no instability. The surgical procedure began with knee arthroscopy via the classic anterolateral and anteromedial portals. Cruciate ligaments were shown as intact and stable with probe, while the menisci appeared to be normal, except for a small incomplete horizontal rupture in the medial meniscus. An avulsed bony fragment was identified in the lateral gutter (Figure 4). An additional posterolateral portal was created to attempt reduction through arthroscopy, but it was unsuccessful. Therefore, we proceeded to the next step by enlarging the posterolateral incision. A straight 4-cm incision was made through the skin and subcutaneous tissue and, then, through the capsule. The bony fragment was reduced and fixed with a staple, and a knee immobilizer was applied.

Following the cessation of the motor block, open chain exercises, specifically straight leg raises, were initiated. The ROM exercises were introduced on the first postoperative day, as tolerated, using a continuous passive motion device. The patient was advised to wear the immobilizer at all times, except during ROM exercises. On the first postoperative day, the patient was able to ambulate with partial weight-bearing using the knee immobilizer and two crutches. After reaching 90 degrees of active knee flexion, the patient was discharged on the third postoperative day.

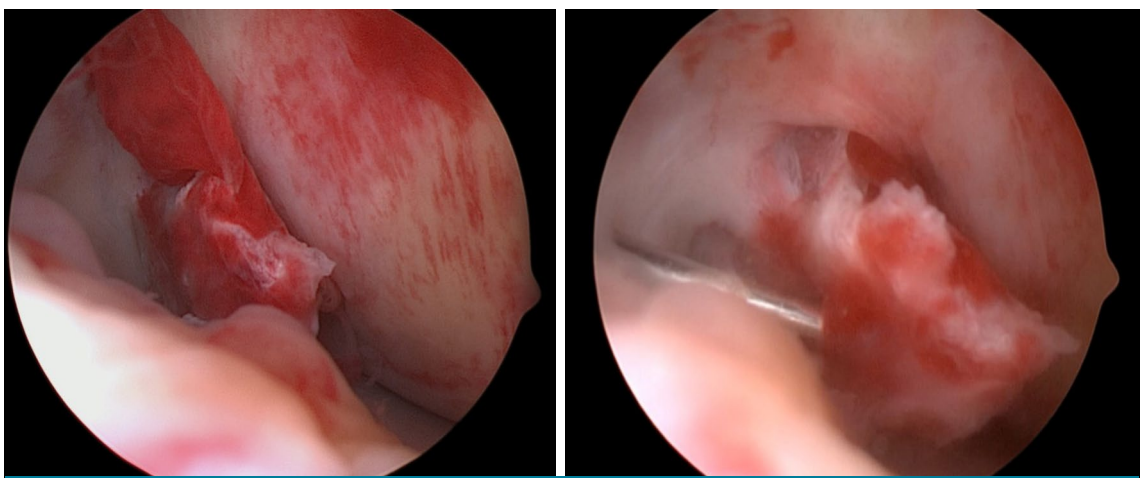

FIGURE 4. Arthroscopic view of avulsed bony fragment.

FIGURE 5. Six-week follow-up X-ray suggesting initial bony healing.

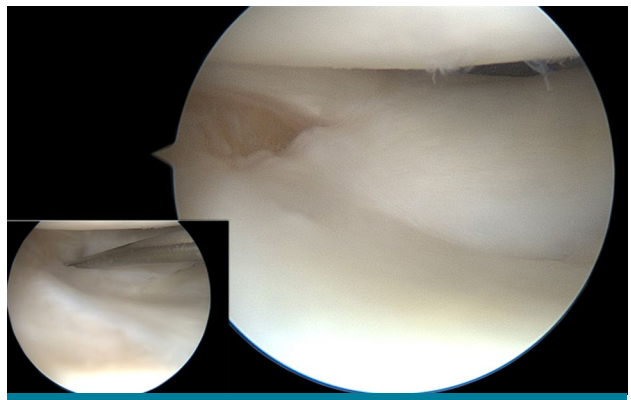

FIGURE 6. Arthroscopic view of healed popliteus tendon.

During the sixth postoperative week, the knee immobilizer was removed, and full weight-bearing was allowed. The patient reported no symptoms and achieved full ROM. During follow-up, X-rays revealed initial indications of bony union of the avulsed fragment (Figure 5).

During the one-year follow-up, the patient complained of tenderness at the site where the staple was placed, but her knee examination was, otherwise, normal. An MRI was performed which revealed the integrity of the PT. To address the issue, a second surgery was performed, involving removal of the staple and a second look arthroscopy. The arthroscopy confirmed the integrity of both cruciate ligaments and menisci, while the PT was tested and found to be fully healed (Figure 6). After a further six months of follow-up, following the second surgery, the patient was free of symptoms and able to return to her pre-injury level of activity.

DISCUSSION

Currently, there is no Level 1 evidence available on the treatment of isolated popliteus injuries in the literature. Reported cases of such injuries are summarized in Table I, suggesting no clear superiority of one treatment over another. Both surgical and conservative treatments have been reported with satisfactory outcomes. Various patient-related factors should be considered while deciding whether or not to opt for surgical intervention, with age being a prominent one. In skeletally immature patients, non-operative treatment may be the preferred option, since both treatment options are appropriate and there is an additional risk of epiphyseal damage in the surgical option. Wheeler et al.[8] published a case series of four patients who had good clinical results after conservative treatment, but the longest follow-up period in that study was only nine weeks. Liu et al.[15] reported two pediatric cases treated with suture anchors and achieved excellent results in the mid-term follow-up. On the other hand, advanced age may serve as a motivating factor for conservative treatment. While there is no established protocol for treating elderly patients, the fact that nearly all cases reported in the literature are of individuals under 30 years of age lends credence to this interpretation. In the case of our 29-year-old patient, she fell into a gray area in this regard and her age was not indictive for treatment of choice.

While considering the time required to return to sports, it is difficult to identify a clear standout method. To illustrate, Conroy et al.[10] reported a six-week period before a professional soccer player could return to sports following arthroscopy. Quinlan et al.[6] also reported a professional rugby player with a rupture of PT at the musculotendinous junction who returned to their pre-injury level of participation after five weeks of rehabilitation. Algazwi et al.[7] reported a 16-year-old soccer player who returned to competitive sports after three months of conservative

TABLE I
Review of published cases of isolated popliteus injury

	Age (year)	Mechanism of injury	Injury type	Treatment	Follow-up period	Outcome
Gruel[3] 1990	15	Skiing	Avulsion	Arthroscopic removal of Osteochondral lesion no tendon repair	2.5 year	Excellent
	16	Football	Avulsion	Removal of loose body arthroscopically, no tendon repair	N/A	Excellent
Garth et al.[4] 1992	12	Football	Avulsion	Fixation with screw	N/A	Good, some residual flexion loss
	14	Wrestling	Avulsion	Arthroscopy assisted reduction thru absorbable sutures	1 year	Excellent
Radhakrishna et al.[5] 2004	N/A	Football	Midsubstance, grade 1	Ice, massage, ROM exercises	N/A	Excellent
Quinlan et al.[6] 2011	23	Rugby	Musculotendinous Junction	5 weeks of rehabilitation program	5 weeks	Excellent
Algazwi et al.[7] 2011	16	Soccer	Avulsion	Rehabilitation following bracing	3 months	Excellent
Wheeler et al.[8] 2008	13	Football	Avulsion	Physiotherapy following bracing	N/A	Excellent
	14	Soccer	Avulsion	Physiotherapy following bracing	N/A	Excellent
	13	Rugby	Avulsion	Physiotherapy following bracing	N/A	Excellent
	14	Motorcycle accident	Avulsion	Physiotherapy following bracing	N/A	Excellent
Westrich et al.[9] 1995	21	Motor vehicle accident	Avulsion	Repair with suture anchors	7 months	Excellent
Conroy et al.[10] 2004	17	Soccer	Intra-substance rupture	Arthroscopic debridement of stump	N/A	Excellent
Burstein and Fischer[19] 1990	24	Football	Avulsion	Diagnostic Arthroscopy	3 months	Excellent
Winge and Phadke.[11] 1996	34	Polo	Muscle tear	Physiotherapy with relative rest	6 weeks	Excellent
		Polo	Muscle tear	Physiotherapy with relative rest	6 weeks	Excellent
Koong et al.[12] 2018	22	Rugby	Avulsion	Physiotherapy	15 months	Excellent
Mariani and Margheritini[13] 2009		Soccer	Partial rupture of tendon	Arthroscopic debridement	7 weeks	Excellent
Guha et al.[14] 2003	23	Football	Complete tear of tendon	Arthroscopic debridement	1 year	Excellent
Liu et al.[15] 2016	11	Sledding accident	Avulsion	Fixation with suture anchor	3 months	Excellent
	16	Football	Avulsion	Fixation with suture anchor	3 months	Excellent
Mirkopulos and Myer[16] 1991	11	Basketball	Avulsion	Fixation with screw and washer	4 year	Excellent

N/A: Not available.

treatment. Early return to competitive sports was possible in both surgical and non-surgical groups, with most cases reporting a return after four to six weeks. Since there is no consensus in the literature on postoperative follow-up protocols and return to sport time, we applied the principles of our own knee surgery tradition. However, we acknowledge that we may have acted too cautiously on late full-weight-bearing, considering some authors have reported good results with early return to sport even after four

weeks.

Most of the reported injuries occur during sports activities, and many of them lack a clear description of the trauma. Typical mechanism of injury is described as the rotation and anterior translation of the femur over the tibia in a flexed knee.[17] However, this was not the case in our patient, leading to the conclusion that not every patient presents with a classic description of the injury.[18] This may be a contributing factor to possible overlooked cases. Rotational or direct forces on a flexed knee seem to be the most inclusive description in reported cases. Localized tenderness on PLC and compatible radiological findings should raise flags about popliteus tendon injury.

It is worth noting that the cases reported in the literature mainly involve professional or semi-professional athletes who have convenient access to personalized physiotherapy. This can lead to a potentially misleading interpretation of the favorable results reported with conservative treatment. The essential close monitoring and follow-up requirements for conservative treatment could not be optimally fulfilled given the patient's specific characteristics and our facilities. Consequently, we proceeded with surgical treatment which allowed us to implement more bold postoperative protocols for ROM and open chain exercises.

In conclusion, we opted for the surgical option based on the patient's characteristics in our case. It is of utmost importance to carefully assess the patient for any signs of instability or concomitant ligament injuries, as these may affect the treatment approach. Surgical treatment may be considered for patients who have higher expectations from medical professionals and may not be as compliant with mid- and long-term follow-up protocols. Access to appropriate physiotherapy should be also considered as a crucial factor in the decision-making process.

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Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Design, writing, data collection, literature review: A.V.; Design, literature review: A.E.D.; Idea, design, supervision, critical review: E.K.B.; Design, supervision: S.A.

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REFERENCES

1. Jadhav SP, More SR, Riascos RF, Lemos DF, Swischuk LE. Comprehensive review of the anatomy, function, and imaging of the popliteus and associated pathologic conditions. Radiographics 2014;34:496-513. doi: 10.1148/rg.342125082.
2. Porrino J, Sharp JW, Ashimolowo T, Dunham G. An update and comprehensive review of the posterolateral corner of the knee. Radiol Clin North Am 2018;56:935-51. doi: 10.1016/j.rcl.2018.06.006.
3. Gruel JB. Isolated avulsion of the popliteus tendon. Arthroscopy 1990;6:94-5. doi: 10.1016/0749-8063(90)90005-x.
4. Garth WP Jr, Pomphrey MM Jr, Merrill KD. Isolated avulsion of the popliteus tendon: Operative repair. A report of two cases. J Bone Joint Surg [Am] 1992;74:130-2.
5. Radhakrishna M, Macdonald P, Davidson M, Hodgekinson R, Craton N. Isolated popliteus injury in a professional football player. Clin J Sport Med 2004;14:365-7. doi: 10.1097/00042752-200411000-00009.
6. Quinlan JF, Webb S, McDonald K, Meikle G, McMahon SF. Isolated popliteus rupture at the musculo-tendinous junction. J Knee Surg 2011;24:137-40. doi: 10.1055/s-0031-1275397.
7. Algazwi DAR, Tian QS, Elizabeth GL, Ellis ES, Teng VSY, Hallinan JTPD. Isolated popliteus tendon avulsion fracture. Am J Phys Med Rehabil 2019;98:e140-1. doi: 10.1097/PHM.0000000000001181.
8. Wheeler LD, Lee EY, Lloyd DC. Isolated popliteus tendon avulsion in skeletally immature patients. Clin Radiol 2008;63:824-8. doi: 10.1016/j.crad.2007.08.014.
9. Westrich GH, Hannafin JA, Potter HG. Isolated rupture and repair of the popliteus tendon. Arthroscopy 1995;11:628-32. doi: 10.1016/0749-8063(95)90145-0.
10. Conroy J, King D, Gibbon A. Isolated rupture of the popliteus tendon in a professional soccer player. Knee 2004;11:67-9. doi: 10.1016/S0968-0160(03)00065-6.
11. Winge S, Phadke P. Isolated popliteus muscle rupture in polo players. Knee Surg Sports Traumatol Arthrosc 1996;4:89-91. doi: 10.1007/BF01477259.
12. Koong DP, An VVG, Lorentzos P, Moussa P, Sivakumar BS. Non-operative rehabilitation of isolated popliteus tendon rupture in a rugby player. Knee Surg Relat Res 2018;30:269-72. doi: 10.5792/ksrr.17.072.
13. Mariani PP, Margheritini F. Partial isolated rupture of the popliteus tendon in a professional soccer player: A case report. Sports Med Arthrosc Rehabil Ther Technol 2009;1:18. doi: 10.1186/1758-2555-1-18.
14. Guha AR, Gorgees KA, Walker DI. Popliteus tendon rupture: A case report and review of the literature. Br J Sports Med 2003;37:358-60. doi: 10.1136/bjsm.37.4.358.
15. Liu JN, Rebolledo BJ, Warren RF, Green DW. Surgical management of isolated popliteus tendon injuries in paediatric patients. Knee Surg Sports Traumatol Arthrosc 2016;24:788-91. doi: 10.1007/s00167-016-4029-x.
16. Mirkopulos N, Myer TJ. Isolated avulsion of the popliteus tendon. A case report. Am J Sports Med 1991;19:417-9. doi: 10.1177/036354659101900419.

17. McConkey JP. Avulsion of the popliteus tendon. J Pediatr Orthop 1991;11:230-3. doi: 10.1097/01241398-199103000-00019.
18. Atik OŞ. Which articles do the editors prefer to publish? Jt Dis Relat Surg 2022;33:1-2. doi: 10.52312/jdrs.2022.57903.
19. Burstein DB, Fischer DA. Isolated rupture of the popliteus tendon in a professional athlete. Arthroscopy 1990;6:238-41. doi: 10.1016/0749-8063(90)90081-n.