



Arteriovenous fistula and pseudoaneurysm in a pediatric patient with persistent postoperative hemarthrosis: A rare complication following arthroscopic repair of a bucket handle medial meniscal tear

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Meniscal tears are common knee injuries, particularly in athletes and individuals engaged in intense physical activities.^[1] In recent years, arthroscopic repair has become a standard approach in treating meniscal tears.^[2] Arthroscopic meniscal repair is recognized as a safe procedure with a low complication rate.^[3] According to the American Board of Orthopaedic Surgery (ABOS) database, the arthroscopic meniscal repair complication rate is 7.6%.^[4] Furthermore, vascular complications represent a minority of all reported complications.^[5] Some previous reports have highlighted vascular

ABSTRACT

This case report highlights a rare complication of arthroscopic meniscal tear which is an arteriovenous fistula and pseudoaneurysm of the superior medial geniculate artery. A 14-year-old male patient presented with persistent hemarthrosis following arthroscopic repair of a bucket handle medial meniscal tear. The patient was investigated due to suspicion of vascular damage. After obtaining computed tomography (CT) arteriogram, the patient was diagnosed with an arteriovenous fistula and pseudoaneurysm of the superior medial geniculate artery. Conservative management was pursued following consultation with cardiovascular surgery. At three months, the arteriovenous fistula was observed to be in remission. In conclusion, orthopedic surgeons performing knee arthroscopy should be vigilant about potential vascular complications, although rare, and consider early diagnosis and treatment in cases of persistent postoperative hemarthrosis.

Keywords: Arteriovenous fistula, arthroscopic repair, case report meniscal tear, pseudoaneurysm.

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complications after arthroscopic knee surgery.^[6-9] However, vascular complications secondary to arthroscopic meniscal repair have been scarcely discussed in the literature.

In this article, we report a pediatric case who developed an arteriovenous (AV) fistula and pseudoaneurysm of the superior medial geniculate artery after arthroscopic meniscal repair and was successfully treated with conservative management.

CASE REPORT

A 14-year-old male patient presented with left knee pain and swelling following a sports-related injury.

Magnetic resonance imaging (MRI) confirmed a displaced bucket handle tear of the medial meniscus in the left knee. Arthroscopic repair of the meniscal tear was performed using three all-inside meniscal sutures posteriorly and posteromedially and four inside-out meniscal sutures medially. The patient was discharged on postoperative Day 1 without obvious complications. A written informed consent was obtained from the parents and/or legal guardians of the patient.

The patient presented to the outpatient clinic on postoperative Day 7 with complaints of pain and swelling in the knee, along with swelling in the left leg. Examination revealed suprapatellar effusion. Therefore, it was decided to perform a suprapatellar puncture to investigate the possibility of hemarthrosis. Defibrinated blood material was aspirated. Then, on postoperative Day 15, the patient returned to the outpatient clinic with similar complaints. Another suprapatellar aspiration was performed based on compatible physical examination findings. Suspecting an iatrogenic vascular injury due to the persistent hemorrhagic nature of the fluid, further investigation was warranted, leading to the patient's admission.

The patient underwent a lower extremity contrast-enhanced computed tomography (CT) arteriogram. The CT arteriogram revealed increased contrast enhancement in the superior medial geniculate artery, along with extravasation of blood in the suprapatellar space, which was connected to the suprapatellar hematoma. Additionally, simultaneous contrast enhancement of the popliteal artery, popliteal vein, genicular venous branches, and vena saphena magna was observed during the early arterial filling phase. Contrast enhancement extended to several veins anterior to the knee, associated with the suprapatellar hematoma (Figure 1). Based on these findings, a diagnosis of an AV fistula arising from the superior medial geniculate artery, along with a subtotal occluded pseudoaneurysm, was established. Following a collaborative assessment with the Cardiovascular Surgery department, it was decided to closely monitor the patient due to the favorable prognosis associated with his relatively good clinical condition and hemodynamic stability, instead of opting for invasive intervention.

The patient exhibited gradual improvement in clinical findings during regular outpatient follow-ups. The CT arteriogram at three months revealed closure of the fistula and complete resolution of hemarthrosis. No pathological findings were detected during the vascular examination and control CT arteriogram in the postoperative second year. The patient's Lysholm score was 90 at two years of follow-up.

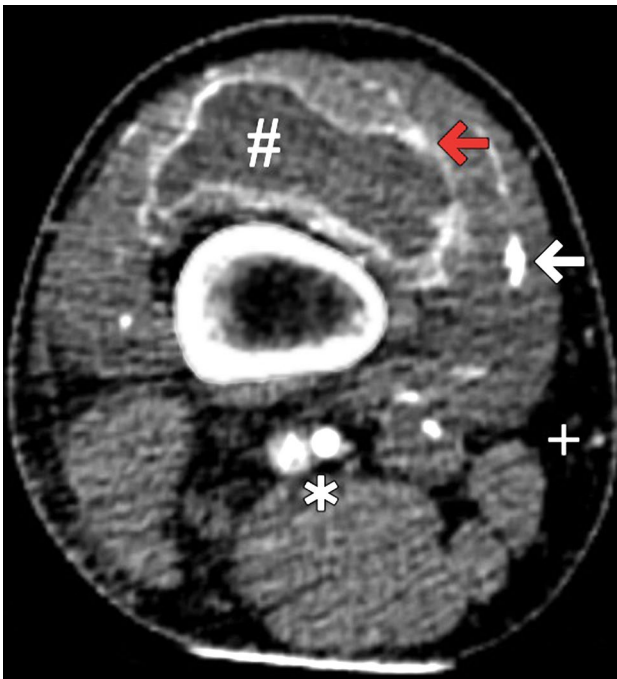


FIGURE 1. Computed tomography arteriogram captured during the early arterial filling phase.

* Simultaneously contrasted popliteal artery and vein; + Contrast-retaining vena saphena magna; # Suprapatellar hematoma; White arrow: Superior medial geniculate artery; Red arrow: Damaged segment of the artery with extravasation from the superior medial geniculate artery.

DISCUSSION

The primary implication of this case study is the AV fistula associated with recurrent hemarthrosis post-arthroscopic meniscal repair. Vascular complications following knee arthroscopy are rarely documented in the literature, with a rate of less than 1%.^[3,10] In the majority of cases, the popliteal artery or its genicular branches are involved.^[11]

Arteriovenous fistulas and pseudoaneurysms can manifest with postoperative pain, a pulsating tumor, calf edema, and hemarthrosis.^[12] In their study, Small^[13] reported the complications of 10,000 arthroscopic surgeries, hemarthrosis was identified as the most prevalent postoperative complication, comprising 60% of all reported complications. Hemarthrosis consistently presents, as observed in this case, within two to three weeks post-surgery.^[14] Persistent hemarthrosis despite the application of pressure dressing should alert the orthopedic surgeon and persistent postoperative hemarthrosis should be taken seriously and diagnosed rapidly.^[15]

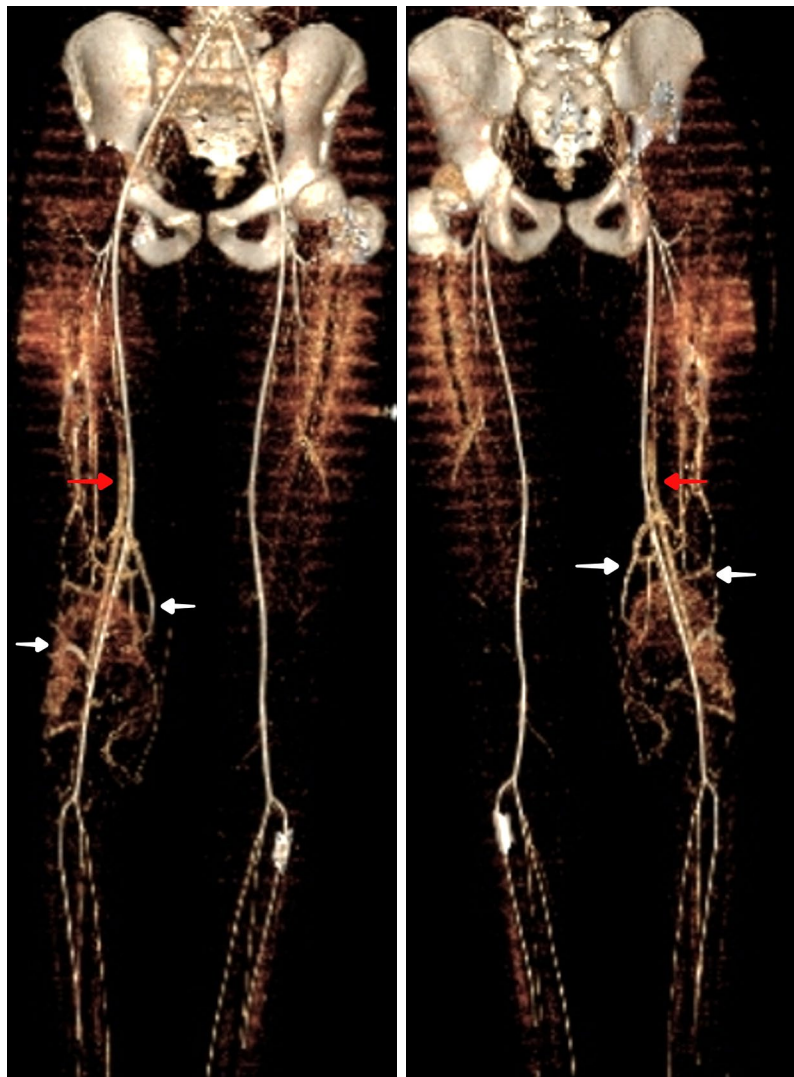


FIGURE 2. Image obtained from the 3D reconstructed sequence of the computed tomography arteriogram during the early arterial phase, showing simultaneous enhancement of the right popliteal vein (red arrow) and genicular branches with the popliteal artery (white arrows).

3D: Three-dimensional.

Although findings such as hemarthrosis or a pulsating mass may prompt the orthopedic surgeon early on, these indicators may not consistently manifest. Occasionally, AV fistulas and pseudoaneurysms may present with pain and leg tension, potentially leading to compartment syndrome and necessitating fasciotomy. In cases of delayed diagnosis, catastrophic outcomes, including amputation, may ensue.^[16] In cases of clinical suspicion, ultrasound, MRI arteriogram, conventional angiography, or, as in this case, three-dimensional (3D) CT arteriogram can be utilized

(Figure 2).^[17] The latter is a rapid, easily accessible, and highly sensitive diagnostic tool.

Once the diagnosis of AV fistulas and pseudoaneurysms is made, endovascular interventions such as embolization and stenting can be utilized in treatment.^[17] Surgical exploration and open surgeries such as direct vessel repair and pseudoaneurysm excision are also commonly preferred options.^[18] In addition, percutaneous thrombin injection under ultrasound guidance is another method that can be employed.^[19] Moreover, observation may also be preferred in cases of small

pseudoaneurysms and when the patient's clinical condition is favorable, as spontaneous resolution is expected in such instances.^[20] In this case, observation was the preferred treatment option due to the absence of any decrease in hemoglobin levels and the clinical deterioration signs such as disproportionate pain or peripheral vascular disorders. As a result, all treatment modalities show a benign prognosis with early intervention, and patients usually recover following these treatments.^[14]

Vascular injury following knee arthroscopy is commonly observed particularly in anterior and posterior cruciate ligament reconstructions and arthroscopic meniscectomies. Arteriovenous fistula following arthroscopic meniscal repair is rarely reported. Additionally, particularly with pseudoaneurysms typically manifesting in the popliteal region. In this case, a pseudoaneurysm in the process of total thrombosis was observed within the suprapatellar pouch. Pseudoaneurysms and AV fistulas which are located on anterior to the knee have often been attributed to portal incisions. However, in this particular case, superomedial portal was not performed. Additionally, a suprapatellar synovectomy which might cause a vascular damage, was not performed. Given the anatomical position of the injured superior medial geniculate artery and the fact that the superomedial portal was not used; it is thought that the injury mechanism may involve accidental penetration of the vastus medialis by the trocar upon initial entry into the suprapatellar region, thereby leading to secondary iatrogenic vascular injury.

Arteriovenous fistulas and pseudoaneurysms developing after knee arthroscopy are often treated with either open surgical direct vessel repair and pseudoaneurysm excision or endovascular interventions. Although conservative management has a role in treatment, it requires close monitoring and may prove insufficient in certain cases. Recognition of these aspects can contribute to developing management and treatment strategies in clinical practice and similar scenarios.

In conclusion, this case report emphasizes the importance of being vigilant for rare, yet potentially serious vascular complications following arthroscopic knee surgeries. Awareness of vascular complications, careful analysis of clinical findings, and early diagnosis through appropriate imaging techniques can lead to favorable outcomes with prompt interdisciplinary management.

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

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