Case Report

Extraarticular infection 9 years after anterior cruciate ligament reconstruction. Case report

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ARTICLE INFO

Keywords:
Anterior cruciate ligament reconstruction
Surgical site infection
Chronic infection
Popliteal cyst
Case report

ABSTRACT

Extraarticular infection after anterior cruciate ligament reconstruction (ACLr) is a rare condition with challenging diagnosis because the symptoms are milder and more insidious when compared to septic arthritis. When late (>2 months after surgery), it tends to be associated with osteomyelitis, requiring more extensive surgical debridement and hardware removal. We report a case of extraarticular infection after ACLr, in the acute phase affecting the tibial site and 9 years after index surgery affecting around the femur site. There was no progression to osteomyelitis at any of the sites. The infection developed a large posterolateral encapsulated abscess, with the endobutton plate loose inside it with its loop intact. In addition to the absence of osteomyelitis progression, there was no sinus tract formation, graft or joint involvement. With open debridement and antibiotic therapy, the patient returned to his activities without limitations. The reported case highlights that extraarticular infection after ACLr, while rare, can be challenging to diagnose and treat. However, with appropriate treatment, it can lead to good results with no functional limitations.

The case

- Extraarticular infection 9 years after anterior cruciate ligament reconstruction.
- There was no progression to osteomyelitis or septic arthritis.
- The infection produced a large posterolateral encapsulated abscess, without a sinus tract. There were no systemic symptoms of infection.
- The endobutton plate was loose inside the abscess with its loop intact. There was no graft compromising.
- With open debridement and antibiotic therapy, the patient returned to his activities without limitations.

Lessons learnt

- Infection and abscess should be considered among differential diagnoses in the face of a large popliteal cyst in the late postoperative anterior cruciate ligament reconstruction (ACLr), even without systemic symptoms.
- Extraarticular infection after ACLr could not be associated with osteomyelitis or septic arthritis.
- Joint aspiration analysis is a valuable test in the presence of extraarticular infection after ACLr to rule out septic arthritis.
- Open debridement and antibiotic therapy in treating extraarticular abscess showed early resumption without limitation.
Introduction

Anterior cruciate ligament reconstruction (ACLr) is one of the most commonly performed procedures in the knee [1,2]. The infection rate is relatively low, ranging between 0.1 and 1.7 % [1,3–5], but it can lead to serious complications such as graft loss, osteomyelitis, chondrolysis and arthrofibrosis [2,3,6,7]. Due to its low incidence, most treatment protocols are based on case reports, experts’ opinions and literature reviews [5,8].

The infection can be intraarticular or extraarticular, with intraarticular cases being the majority of publications [9]. Infections can also be categorized as acute (within 2 weeks after surgery), subacute (between 2 weeks and 2 months) or late (more than 2 months) [4], with the last ones often being extraarticular and associated with osteomyelitis [1,3].

The main objective of this paper is to report a case of an extraarticular infection affecting the femur site 9 years after ACLr surgery. The case is notable for the absence of systemic symptoms or osteomyelitis and the presence of a loose endobutton plate with its loop intact, without compromising the clinical stability of the knee.

Statement of informed consent

The patient was informed that the data regarding the case would be submitted for publication.

The patient agreed and provided written informed consent.

Case

A 33-year-old male underwent right knee arthroscopic ACLr surgery in 2014 using hamstrings autograft, fixed with an endobutton plate to the femur and a titanium interference screw to the tibia, without any associated injuries.

Ten days after the surgery, hyperaemia started in the tibial wound with a small drainage of serous secretion. Oral antibiotics for 21 days managed the condition. Five months after the index surgery the patient developed purulent drainage at the same site. The patient was hospitalized for surgical debridement of the soft tissues and tibial tunnel, removal of the interference screw, and received intravenous (IV) antibiotic therapy. Soft tissue cultures were positive for *Staphylococcus aureus* sensitive to all tested antibiotics. Bone tissue cultures were negative. Thus, IV antibiotics were maintained for two weeks and orally for another two weeks. During the follow-up, there was no knee pain or functional loss, and the patient progressed well in the rehabilitation protocol without limitations, ultimately returning to sports 8 months after surgery.

The patient returned in January 2023 with a noticeable increase in volume in the posterolateral region of the operated knee over the past 5 months (Fig. 1). Local discomfort was reported, but there was no increase in local temperature, hyperaemia, fever or other systemic symptoms of infection. The tumour had developed without any trauma and gradually increased in size. Physical examination revealed a stable knee with negative results on anterior drawer, Lachman’s and pivot shift tests, without effusion or limitation in range of motion. During palpation, the tumour exhibited a non-warm temperature, a cystic consistency, well-defined boundaries, limited mobility, and no adhesion to superficial tissues. The patient complained of discomfort during the final degrees of knee flexion. Radiographic images showed a loose endobutton plate on the posterolateral side of the distal thigh. Magnetic resonance imaging (MRI) revealed a large encapsulated cystic formation with thick liquid content, located extracapsularly along the posterior surface of the distal posterolateral region of the thigh. It had no contact with the bone and was positioned deep to the muscles’ portions of the biceps femoris and semitendinosus. The measurements in the axial and sagittal views were 9.3 × 6.3 cm and 12.8 × 6.8 cm, respectively. Furthermore, the endobutton plate was found loose inside the cyst (Fig. 2). There was no contact between the cyst and the femoral bone tunnel. The graft was intact and well-integrated. There were no signs of osteomyelitis around the bone tunnels or at other sites. At that point, infection was not suspected, so blood tests were conducted only for complete blood count (CBC), and it was normal.

Fig. 1. Posterior view of the lower limbs of the patient, nine years after the ACLr of the right knee. A large increase in volume is seen in the posterolateral region of the right knee.
The initial diagnostic hypothesized was a popliteal cyst. Due to the patient’s symptoms and the cyst’s significant size, along with the presence of a loose fixation device inside it, surgical intervention was proposed and the patient consented to the procedure.

An open surgery was performed to excise the cyst. The patient was positioned prone, allowing posterior access to the knee, without the use of a tourniquet. A hockey stick-shaped incision was made, originating along the path of the biceps femoris, descending obliquely through the popliteal fossa and terminating just above the medial aspect of the gastrocnemius. Subsequently, the popliteal fascia was incised, revealing the cyst located beneath the muscle and tendinous portion of the biceps femoris. The cyst exhibited no adhesion to surrounding tissues, had no contact with the bone, and was easily excised. Moreover, the popliteal artery was in its typical anatomical position. The surrounding tissues showed no adherence to the cyst and displayed no signs of involvement. During the procedure the cyst was ruptured, releasing a large amount of purulent material. At this point, we realized it could be an infection and the cyst could be actually an encapsulated abscess. The endobutton plate was loose with its loop intact inside the abscess (Fig. 3). Intravenous antibiotic therapy was initiated after collecting two samples of the abscess (liquid and capsule) for culture. Another sample was sent for pathological evaluation. A bone tissue sample was not collected because there was no connection between the abscess and the bone. Given this unusual finding, a joint aspirate was performed to collect synovial fluid for laboratorial analysis and culture. Blood was collected for CBC, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) tests to aid in follow-up.

Soft tissue and abscess fluid cultures were positive for S. aureus sensitive to all tested antibiotics. Pathological evaluation concluded that the sample had characteristics consistent with infection. Synovial fluid laboratory analysis was normal and its culture was negative. CBC results were normal, ESR was 30 mm/h and CRP 20 mg/L.

Thus, 800 mg of sulfamethoxazole associated with 160 mg of trimethoprim (Bactrim F) orally every 12 h for 21 days was given. The condition resolved within 30 days, with excellent healing of the surgical wound and normalization of ESR and CRP values. The patient returned to his normal activities with no limitations during the last evaluation 5 months after the surgery.

**Discussion**

Extraarticular infection after ACLr has low incidence [6,9], but require immediate intervention to heal and prevent migration to the articular site [3,5,6]. The case reported demonstrates that late-stage...

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Fig. 2. A) Radiographic imaging of the affected knee – lateral view. The endobutton plate is seem loose in the posterior site of the knee (red circle), B) MRI of the affected knee – T2 sagittal view. The endobutton plate is seem (red circle) loose inside the cist (red asterisk).

Fig. 3. Intraoperative image showing the removed cyst, syringe with the purulent content of the cyst and the endobutton plate with its loop intact.
infection can manifest as a popliteal cyst, lacking systemic symptoms, thereby complicating the diagnostic process even further. Sutures, the graft, bone tunnels and cannulated screws can serve as pathways for infection reach to the joint [1,7]. The initial diagnosis of these conditions is often more challenging than septic arthritis because the symptoms used to be more insidious and less painful [3,6]. The reported case presented three infection situations, one acute and two late. Initially, the tibial site was affected, and after 9 years, the femoral site. At no time did the patient show signs of joint infection, leading us to assume that there was no communication between the two foci.

It is suggested that a foreign body reaction to fixation devices may stimulate inflammatory mediators, subsequently causing the device migration [3]. This hypothesis could explain what happened in our patient. A foreign body reaction to either the titanium plate or the button's loop potentially had led to late migration of the implant. However, this remains speculative as the pathological analysis did not show such a reaction, although it aligns with existing literature [3]. This aspect contributes to the uniqueness of this case.

The literature mentions cases of interference screw loosening, but the migration and loosening of the endobutton plate as reported here is a very rare situation [10]. Bouguennec et al. [11] reported a case of late migration (occurring 3 years post-surgery) of the endobutton also with the loop intact, attributed to titanium hypersensitivity. In their case, the fixation device protruded through the skin without any sign of infection. The graft remained unaffected, preserving knee stability, and MRI showed good femoral bone tunnel integration of the graft. Williams et al. [12] reported another case of button migration into the joint, without the loop in this case, two years after the surgery, also without graft compromising. Consequently, it can be inferred that the late migration of the button, even with the loop intact, does not seem to impact graft integration or functionality, even though this could be considered as a graft failure.

Subsequently, bacterial contamination of the loosening hardware might have occurred and the formation of a purulent collection (abscess), contained by the capsule formation. The encapsulation of the abscess might elucidate the patient's minimal systemic response, resulting only in discomfort due to increased volume.

Although absent in our case, these late situations often involve osteomyelitis [2], requiring open debridement, with reported cases even involving the use of a spacer with antibiotics in the bone tunnel to control the infection [6,9]. The diagnosis of osteomyelitis was ruled out based on the absence of contact between the abscess and bone. This led to the decision not to collect bone samples during surgery for culture. Additionally, MRI did not reveal any signs of inflammation in the bone tissue. The patient's recovery, with infection control, also supported this hypothesis.

The most common bacteria associated with ACLr infection are *S. aureus*, *Staphylococcus epidermidis* and other coagulase-negative *Staphylococcus* species [1–4]. Chronic infections are more related to enterococcus [3]. Despite the condition persisting for five months, the patient's tests revealed positive for *S. aureus*, suggesting a hematogenous origin. The use of hamstring grafts is associated with a higher risk of infection, with a rate of 1.4 % compared to 0.5 % with the patellar tendon [1,2,4]. The use of hamstring grafts is associated with a higher risk of infection, due to the absence of osteomyelitis, the endobutton loosening with its migration [3]. This hypothesis could explain what happened in our patient. A foreign body reaction to either the titanium plate or the button's loop potentially had led to late migration of the implant. However, this remains speculative as the pathological analysis did not show such a reaction, although it aligns with existing literature [3]. This aspect contributes to the uniqueness of this case.

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Koh et al. [3] reported an infection case, 4 years after surgery, at the tibial site, also with no joint involvement but with osteomyelitis. Debridement and interference screw removal were necessary. After 9 years of the index surgery, the patient presented a sinus tract at the femur site this time, also with osteomyelitis, requiring debridement and the removal of the endobutton, which was not loose. Our case was different due to the absence of osteomyelitis, the endobutton loosening with its migration intact, and the containment of the abscess by the capsule, without the formation of a sinus tract.