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Case report

Acute compartment syndrome following arthroscopic surgery for anterior cruciate ligament reconstruction: case report

Síndrome compartimental aguda após cirurgia artroscópica para correção de rompimento de ligamento cruzado anterior: relato de caso

Marcelo José da Silva Magalhães[1] | Alessandra Soares Pinto Mendes de Freitas[1] | Fernanda Paulo Santana[1]

[1]Centro Universitário do Norte de Minas (Uninorte Minas), Montes Claros, MG, Brazil. [ROR: https://ror.org/05t3h0r03]

Resumo

Objetivo: relatar um caso de síndrome compartimental aguda (SCA) como complicação pós-operatória de reconstrução do ligamento cruzado anterior (LCA) realizada por artroscopia. **Relato de caso:** paciente do sexo masculino, 21 anos, submetido à reconstrução artroscópica do LCA e meniscectomia no joelho direito. No terceiro dia pós-operatório, apresentou febre, edema e sinais clínicos compatíveis com artrite séptica. No sexto dia, evoluiu com dor intensa e progressiva, além de aumento do volume e da pressão na região lesionada, sendo diagnosticada SCA. Foi realizada fasciotomia de emergência para descompressão dos compartimentos afetados. Após controle da infecção e debridamento, o fechamento cirúrgico foi efetuado com sucesso. O paciente recebeu alta hospitalar em condições clínicas estáveis, mas manteve claudicação leve mesmo após oito meses de recuperação. A ocorrência de SCA após cirurgia artroscópica de joelho é rara, mas pode ser precipitada por infecções como a artrite séptica. O atraso no diagnóstico pode resultar em sequelas permanentes. A monitorização cuidadosa no pós-operatório e a suspeita clínica são essenciais para a detecção precoce. A intervenção cirúrgica imediata é crucial para evitar complicações graves, como perda funcional do membro. **Conclusão:** este caso ressalta a necessidade de vigilância pós-operatória intensiva mesmo em procedimentos minimamente invasivos. A SCA, embora incomum após artroscopia de joelho, representa uma complicação em potencialmente que exige reconhecimento e tratamento rápidos.

Palavras-chave: Síndrome compartimental aguda. Ligamento cruzado anterior. Artroscopia. Complicações pós-operatórias. Fasciotomia.

Abstract

Objective: to report a case of acute compartment syndrome (ACS) as a postoperative complication of arthroscopic anterior cruciate ligament (ACL) reconstruction. **Case report:** a 21-year-old male patient underwent arthroscopic ACL reconstruction and meniscectomy of the right knee. On the third postoperative day, he developed fever, edema, and clinical signs consistent with septic arthritis. On the sixth day, he progressed with intense and progressive pain, in addition to increased volume and pressure in the affected region, and was diagnosed with ACS. Emergency fasciotomy was performed to decompress the affected compartments. After infection control and debridement, surgical closure was successfully achieved. The patient was discharged from the hospital in stable clinical condition but maintained mild claudication even after eight months of recovery. The occurrence of ACS after arthroscopic knee surgery is rare but may be precipitated by infections such as septic arthritis. Delayed diagnosis may result in permanent sequelae. Careful postoperative monitoring and clinical suspicion are essential for early detection. Immediate surgical intervention is crucial to prevent severe complications, such as functional loss of the limb. **Conclusion:** this case highlights the need for intensive postoperative surveillance even in minimally invasive procedures. ACS, although uncommon after knee arthroscopy, represents a potential complication that requires prompt recognition and treatment.

Keywords: Acute compartment syndrome. Anterior cruciate ligament. Arthroscopy. Postoperative complications. Fasciotomy.

Corresponding author: Marcelo José da Silva de Magalhães| marcelo7779@yahoo.com.br
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Introduction

Anterior cruciate ligament (ACL) tear repair surgery is a common orthopedic procedure designed to restore knee stability after injuries, which often occur during sports activities or trauma[1].

The ACL is one of the main ligaments that connect the femur to the tibia, and its rupture can lead to joint instability, pain, and difficulty performing simple movements, such as walking or rotating the knee. Surgery usually involves reconstructing this ligament using grafts, which can be autologous (taken from the patient themselves, such as the patellar tendon or hamstring tendons) or from donors[2]. The goal of this technique is to replace the damaged ligament with tissue that simulates its function, allowing for the recovery of stability and the prevention of future injuries, such as damage to the cartilage or menisci[3].

ACL reconstruction surgery can be performed using video-assisted surgery, a minimally invasive technique that uses a camera and specialized instruments to perform the procedure through small incisions. This approach, known as arthroscopy, offers significant advantages compared to open surgery, such as less postoperative pain, reduced risk of infection, and faster recovery[4]. During arthroscopy, the surgeon visualizes the inside of the joint on a monitor and performs ligament reconstruction with precision. Studies prove that video surgery is as effective as the traditional technique, with the added advantage of less surgical trauma and smaller scars, making it the preferred option for most cases of ACL rupture[5].

Potential complications can arise, such as joint stiffness (arthrofibrosis), graft failure, infection, and anterior knee pain. Arthrofibrosis is one of the most challenging complications, as it can lead to limited range of motion[6]. In addition, graft failure, often associated with inadequate surgical technique or aggressive early rehabilitation, has been highlighted as a major cause of reoperation[7]. Postoperative infections, although rare, can result in significant morbidity. Among other rare complications is acute compartment syndrome (ACS)[6].

Acute compartment syndrome is a serious medical condition that occurs when pressure within a compartment containing muscle, nerves, and blood vessels increases to dangerous levels. This elevated pressure can compromise blood flow to the tissues within the compartment, leading to ischemia and potentially cell death[8]. Symptoms include intense pain, swelling, numbness, paleness, and difficulty moving the affected area. If not treated promptly, compartment syndrome can result in permanent damage to muscles and nerves and even lead to amputation of the affected limb[9].

This syndrome is most common in cases of trauma, such as bone fractures, crush injuries, or repetitive strain injuries, especially in athletes[10]. It can also occur, in rarer cases, after surgery,

severe burns, or prolonged immobilization of a limb. Acute compartment syndrome, which develops rapidly, is a medical emergency and requires immediate intervention, usually with a fasciotomy, a surgical procedure that opens the affected compartment to relieve pressure[11].

Although arthroscopy for ACL reconstruction is a well-established minimally invasive technique with recognized advantages such as less postoperative pain and faster recovery, it is not without serious complications. ACS is a devastating orthopedic emergency, classically associated with high-energy trauma and fractures, but only reported in elective arthroscopic procedures. Given the rare and potentially catastrophic nature of ACS in this context, it is necessary to document and alert the medical community about this possible association. This report aims to fill a gap in the literature, serving as a crucial warning for orthopedic surgeons to consider this differential diagnosis, even in an apparently low-risk postoperative scenario, potentially preventing poor functional outcomes and saving limbs.

The aim was to report a case of acute compartment syndrome as a complication of ACL repair performed arthroscopically.

Case report

This work was approved by Plataforma Brasil with the CAAE number 89862225.1.0000.5141.

A 21-year-old male patient was admitted to the referral hospital on September 12, 2024, with a diagnosis requiring ACL reconstruction and meniscectomy via video arthroscopy, secondary to a sprain and strain of the ACL in his right knee, following an accident during a soccer game.

The patient underwent ACL reconstruction and meniscectomy of the right knee via video arthroscopy on the same day. The anesthesia used was spinal anesthesia with adequate antisepsis. The procedure was uneventful, with skin suturing and application of a sterile dressing. The patient was transferred to the post-anesthesia recovery unit and instructed on postoperative care.

The patient developed septic/pyogenic arthritis in the right knee three days after surgery, with significant inflammation and risk of complications. Among the symptoms, the patient presented with a measured fever of 39º, associated with prostration and significant pain in the surgical scar. In addition, he presented with significant edema, redness, and local ecchymosis, as shown in Figures 1A, 1B, and 1C.

Figure 1A. Day 1 post-ACL reconstruction and meniscectomy surgery. **Figure1B.** Day 2 post-ACL reconstruction and meniscectomy surgery. **Figure1C.** Day 4 post-ACL reconstruction and meniscectomy surgery.

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On the sixth postoperative day, during his hospital stay, the diagnosis of compartment syndrome in the right lower limb was confirmed. The patient underwent an emergency fasciotomy procedure to relieve intracompartmental pressure and restore adequate blood perfusion.

Surgical debridement was performed five days after the fasciotomy to remove necrotic or infected tissue, which favored an environment conducive to proper healing and infection control. On the seventh day, the skin was sutured after controlling compartment pressure and infection, as shown in Figures 2A, 2B, and 2C.

The following day, the patient presented a stable condition, without signs of compartment syndrome or complications from infections. Pain in the surgical wound was controlled, and passive mobilization of the limb did not result in pain. The dressing was clean and dry, with good peripheral perfusion. Due to his stable condition, he was discharged from the hospital on September 26, 2024, under medical guidance for postoperative care and continuous monitoring.

He began rehabilitation treatment with physiotherapy and strengthening through weight training. After eight months of rehabilitation, he still presented with a limp. Figures 3A and 3B show the scar currently, evidencing complete recovery after the procedure.

Figures 2A and 2B. Day 1 post-fasciotomy surgery. **Figure 2C.** Day 4 after fasciotomy suture.

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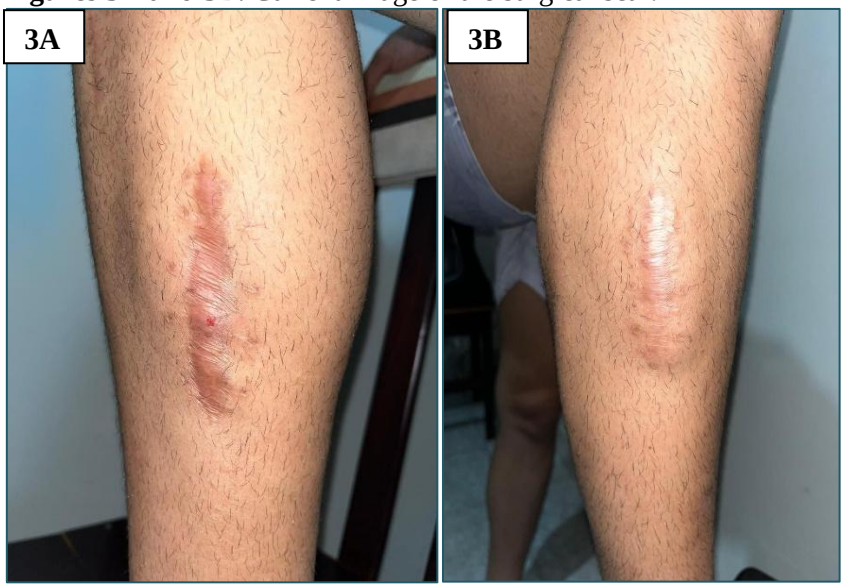
Figures 3A and 3B. Current image of the surgical scar.



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Discussion

This report describes an unusual progression of postoperative complications in a young patient undergoing arthroscopic ACL reconstruction: the onset of septic arthritis on the third postoperative day, evolving into ACS on the sixth day, requiring emergency fasciotomy and residual claudication after eight months of rehabilitation. The association between postoperative infection and ACS, although rare in this context, is supported by the literature, which points to infections as risk factors for increased intracompartmental pressure in orthopedic surgeries[12]. As

reported, studies demonstrate that ACS can occur even in the absence of fractures, being triggered by conditions that compromise local tissue perfusion[13]. The late diagnosis, confirmed only on the sixth day, highlights that the delay in intervention is directly associated with permanent functional sequelae, making urgent decompressive fasciotomy the only definitive treatment capable of reversing ischemia and preserving the limb[14].

ACL injuries are frequently associated with indirect trauma mechanisms, such as sudden changes of direction, abrupt stops, or improper landings after jumps, common in sports such as soccer, basketball, and skiing[15]. Intrinsic factors, such as biomechanical alignment, ligamentous laxity, and anatomical differences in the lateral patellar condyle groove, also increase the risk[1]. Female athletes have a higher incidence due to hormonal, biomechanical, and neuromuscular influences[16]. Corroborating the literature, the patient in the case report presented with an ACL injury during sports practice.

ACL reconstruction can be performed through open or arthroscopic (endoscopic) surgery, the latter being the preferred technique due to lower morbidity, faster recovery, and anatomical precision[17]. Autologous grafts, such as the patellar tendon or flexor tendons (semitendinosus and gracilis), are the most commonly used, while alloplastic and synthetic techniques are less frequent alternatives[2]. Open surgery, although less common today, is still indicated in complex cases with associated lesions[18].

Despite the safety of arthroscopy, complications such as infections, deep vein thrombosis, joint stiffness, and graft failure can occur[19]. Rare cases of ACS, as reported in the study under analysis, are associated with postoperative infections or excessive leakage of irrigation fluid[20]. Septic arthritis, although uncommon, requires early diagnosis to avoid irreversible damage[21]. The present case illustrates that infections can occur postoperatively, as well as more serious and severe complications such as ACS.

Although knee arthroscopy is considered a minimally invasive technique with low complication rates, the development of ACS postoperatively highlights the importance of rigorous monitoring of signs such as disproportionate pain, edema, and neurovascular changes.[12] In this case, ACS was preceded by septic arthritis, suggesting that the infection may have contributed to increased intracompartmental pressure, worsening the clinical picture. Rapid intervention with fasciotomy proved crucial to avoid irreversible tissue damage, reinforcing the need for immediate diagnosis and treatment.

Septic arthritis is an orthopedic emergency that requires immediate intervention to protect articular cartilage. Treatment is based on initial empirical intravenous antibiotic therapy, adjusted after identification of the etiological agent (usually Staphylococcus aureus), associated with joint

decompression through serial arthrocentesis or surgical drainage[22]. In severe cases, such as those associated with postoperative infections, arthroscopy or open lavage may be necessary to remove necrotic tissue and bacterial biofilms[23]. Temporary immobilization and early rehabilitation are essential to restore joint function[24].

Septic arthritis, identified three days after surgery, was a determining factor in the evolution of ACS. Postoperative infections, although uncommon in arthroscopic procedures, can lead to systemic and local complications, such as exacerbated inflammation and impaired tissue perfusion. The report pointed to infections as one of the risk factors for ACS in orthopedic surgeries. The combination of infection and post-surgical edema likely increased pressure in the leg muscle compartments, requiring urgent intervention[14]. This scenario highlights the importance of early antibiotic therapy and abscess drainage in cases of septic arthritis.

ACS represents a surgical emergency in which increased pressure within an osteofascial compartment leads to tissue ischemia and, if not treated urgently, results in muscle necrosis, permanent neuropathy, and contracture[13]. The patient in this case report underwent fasciotomy, which was subsequently complemented by debridement to remove necrotic material, corroborating the available medical literature[11,13].

The diagnosis is primarily clinical, supported by measuring intracompartmental pressure when the physical examination is inconclusive or the patient is unconscious. The definitive and urgent treatment is decompressive fasciotomy, which should be performed as quickly as possible to relieve pressure and restore tissue perfusion. Delay in intervention is directly associated with catastrophic and irreversible sequelae8, with fasciotomy being a limb-saving procedure that requires immediate recognition of the condition to avoid debilitating outcomes[13].

ACS is a time-sensitive condition, and delayed treatment can result in muscle necrosis, contractures, or even amputation. This report illustrates the effectiveness of fasciotomy in restoring blood perfusion, followed by debridement to remove necrotic tissue. The multidisciplinary approach, including infection control and surgical reassessment, was fundamental to stabilizing the patient. Successful wound closure after seven days indicates a favorable outcome, despite the initial severity[13].

Studies show that ACS victims often face long-term challenges, such as chronic pain and loss of strength[25]. In this case, a favorable prognosis may be associated with rapid intervention and proper infection management, but highlights the need for continuous follow-up to optimize functional recovery. The prolonged rehabilitation described in the case report, with physiotherapy and muscle strengthening, reflects the functional impact of ACS and the previous infection. Even

after eight months, the patient presented with limping, suggesting neuromuscular sequelae or compensatory adaptations.

Despite the important findings of this study, since this is a single case report, they cannot be generalized to the population, limiting statistical inferences or the establishment of definitive causal relationships between septic arthritis and the development of ACS.

Conclusion

This case reinforces the need for detailed guidance to patients regarding warning signs in the postoperative period, such as fever, intense pain, or changes in sensation. Health education can accelerate the seeking of care, reducing sequelae. Although ACL arthroscopy is safe, complications such as ACS and infections require teams prepared for emergency management. Reports like this contribute to the literature, highlighting the complexity of the orthopedic postoperative period and the importance of proactive approaches to ensure satisfactory outcomes.

Authors' contributions

Research conception and design: Alessandra Soares Pinto Mendes de Freitas, Fernanda Paulo Santana, Marcelo José da Silva de Magalhães. Analysis, interpretation of data and manuscript writing: Alessandra Soares Pinto Mendes de Freitas, Fernanda Paulo Santana, Marcelo José da Silva de Magalhães. Resource management: Alessandra Soares Pinto Mendes de Freitas, Fernanda Paulo Santana, Marcelo José da Silva de Magalhães. Critical review of the manuscript regarding intellectual content and final presentation: Marcelo José da Silva de Magalhães, Fernanda Paulo Santana. The authors approved the final version of the manuscript and declared themselves responsible for all aspects of the work, including ensuring its accuracy and integrity.

Conflict of interests

The authors state that there are no conflicts of interests.

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