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Review article

Pseudoaneurysm after arthroscopic procedure in the knee[☆]



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ABSTRACT

The aim of this study was to review all cases of pseudoaneurysm in the literature, in predominantly arthroscopic procedures on the knee, and to report on a case of pseudoaneurysm that we treated. A bibliographic search was conducted for scientific articles published in Brazilian and foreign periodicals over the last 23 years. Forty-seven cases were found, in 40 articles. In addition to these 47 cases, there was the case that we treated, which was also included in the data. Among the operations that progressed with formation of a pseudoaneurysm, 60% were cases of meniscal injuries and 23%, anterior cruciate ligament injuries. In 46% of the cases, the artery affected with the popliteal, and in 21%, the inferomedial genicular artery. The commonest clinical symptom was pain (37%), followed by pulsating tumor (31%), edema of the calf (12%) and hemarthrosis (11%). The median time taken to make the diagnosis was 11 days, but it ranged from one day to 10 weeks after the procedure. Although rare, pseudoaneurysms are a risk that is inherent to arthroscopic surgery. All patients should be made aware of the vascular risks, even in small-scale procedures.

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Pseudoaneurisma após procedimento artroscópico no joelho

RESUMO

O objetivo deste estudo é revisar na literatura todos os casos de pseudoaneurisma em procedimentos predominantemente artroscópicos do joelho e relatar um caso de pseudoaneurisma tratado pelos autores. Foi feita uma pesquisa bibliográfica por meio de artigos científicos publicados em periódicos nacionais e internacionais nos últimos 23 anos. Foram levantados 47 casos, em 40 artigos. Somou-se aos 47 um caso dos autores deste estudo que foi incluído nos dados. Das cirurgias que cursaram com pseudoaneurisma, 60% se tratavam

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de lesões meniscais e 23% de lesões do ligamento cruzado anterior. Em 46% dos casos a artéria acometida foi poplíteia e em 21% a artéria genicular inferomedial. O sintoma clínico mais comum foi dor (37%), seguido de tumor pulsátil (31%), edema de panturrilha (12%) e hemartrose (11%). A mediana do tempo para diagnóstico foi de 11 dias, mas variou de um dia até 10 semanas após o procedimento. Apesar de raro, o pseudoaneurisma é um risco inerente à cirurgia artroscópica. Todo paciente deve ser notificado dos riscos vasculares, mesmo em procedimentos de pequeno porte.

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Introduction

Knee arthroscopy is among the most commonly performed surgical procedures for treating sports injuries.¹ Arthroscopic reconstruction of the anterior cruciate ligament (ACL) alone accounts for 75,000 cases per year in the United States.²

Use of arthroscopy has grown because it entails less injury to soft tissues in order to perform the procedure. With precise guides and use of cameras, it is possible to increase the surgeon's efficacy and diminish the damage to the patient. However, direct viewing of the surrounding structures is no longer done routinely, which may lead to unexpected injuries. One example of this is the reports of pseudoaneurysms after arthroscopic procedures have been performed on the knee.^{3,4}

Pseudoaneurysms are caused by incomplete injury to the arterial wall, with extravasation of blood that is contained by the surrounding tissues. This blood accumulation is organized in a fibrous capsule with the presence of turbulent flow inside it⁵ (Fig. 1).

Over the course of the natural evolution of pseudoaneurysms, they may increase in size until they rupture or cause ulceration in the neighboring structures.^{3,5,6}

Because pseudoaneurysms are a rare complication, a high degree of suspicion is needed for an early diagnosis to be made.⁷ The literature of pseudoaneurysms subsequent to arthroscopic procedures on the knee is sparse and only a few reports exist.

The objective of this study was to review all the cases of pseudoaneurysm in the literature resulting from predominantly arthroscopic procedures on the knee (treatments relating to ACL, meniscal injuries, synovectomy and osteochondritis) and report on a case of pseudoaneurysm that we treated.

Method

A bibliographic survey was conducted among scientific articles published in Brazilian and foreign periodicals over the last 23 years, using the PubMed and Bireme databases. The survey was conducted in two stages on the PubMed website: firstly, using the terms *pseudoaneurysm* OR *false aneurysm* and *knee* OR *cruciate* OR *arthroscopy*; and secondly, using *pseudoaneurisma* OR *falso aneurisma* and *joelho* OR *cruzado* OR *artroscopia*. In the Bireme database, the terms were used separately. Ten combinations would be needed in order to have a similar search, as follows: *pseudoaneurysm knee*, *pseudoaneurysm*

cruciate, *pseudoaneurysm arthroscopy*, *false aneurysm knee*, *false aneurysm cruciate*, *false aneurysm arthroscopy*, *pseudoaneurisma joelho*, *pseudoaneurisma cruzado*, *pseudoaneurisma artroscopia*.

Reports on cases of pseudoaneurysm of the knee subsequent to predominantly arthroscopic procedures were selected (cases relating to ACL, meniscal injuries, synovectomy and osteochondritis). Some other articles were found through examining the reference lists of the articles selected. No prospective or retrospective studies on this subject were found, and not even any case series. The maximum number of cases reported per article was three.⁸ The review was checked up to June 24, 2011.

Articles in five languages were found: English (31), French (3), Portuguese (1), German (1) and Serbian (1). The points of interest in the article in Serbian were kindly translated into English for us so that they could be included in this study.⁹

For the purposes of the present study, it was not of interest to review the opinions of specialists but, rather, the case reports, given that there was no stronger evidence than this, on this subject, up to the time of this study.

Case report

Our patient was a 17-year-old male who presented a complete tear of the ACL subsequent to twisting his right knee while playing handball. Arthroscopic reconstruction of the ACL was performed using a graft from the flexor tendons of the knee.

Two and a half years later, he twisted his right knee again, and this led to a complaint of instability and recurrent episodes of joint effusion. He sought assistance at the orthopedics service of the Sports Traumatology and Arthroscopy Center, where a diagnosis of a new ACL injury was made. Surgical revision of the reconstruction was therefore scheduled. The graft used was from the tendon of the quadriceps muscle. Extensive repair to the femoral intercondylar area was also performed.

On the first postoperative day, the patient complained about joint effusion in the knee and about the presence of a pulsatile mass in the inferomedial region of the right knee that was causing pain and discomfort. An echo Doppler test confirmed the clinical diagnosis of pseudoaneurysm. The patient was sent to the vascular surgery department, where embolization of the pseudoaneurysm was performed. Arteriography showed that the pseudoaneurysm was in the inferomedial genicular artery. The patient then made a good recovery without any interurrences.

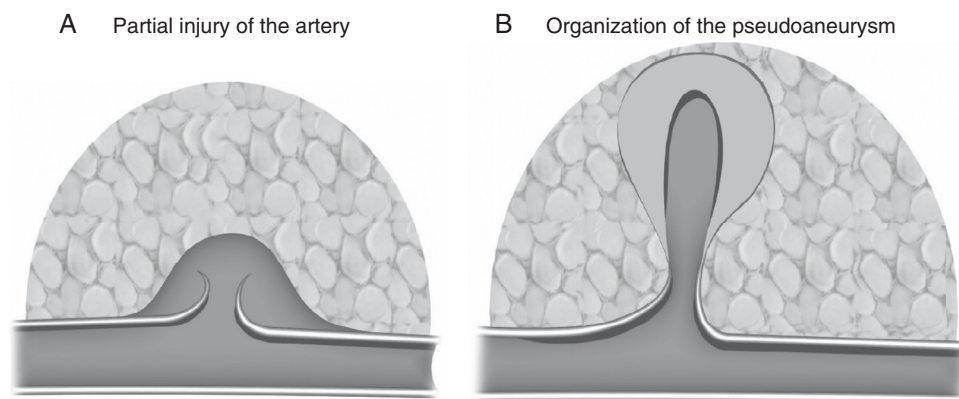


Fig. 1 – Schematic drawing of the formation of a pseudoaneurysm.

Table 1 – Diagnoses found in the literature surveyed.

Diagnosis	Number of patients	Percentage (%)
Meniscus	29	60.41
Synovitis	3	6.25
Arthrosis	2	4.16
ACL	11	22.91
Osteochondritis	1	2.08
Synovectomy	1	2.08
Baker's cyst	1	2.08

Review of the literature

Forty-seven cases in forty articles were surveyed.^{4,6-43} In addition, our single case described above was included in the data.

The first case of pseudoaneurysm subsequent to an arthroscopic procedure on the knee dates back to 1979.¹³ We do not believe that any older cases exist, because arthroscopy only became popular in the 1990s.

From the present investigation, 75% of the patients were male and 25% were female, and their ages ranged from 13 to 69 years. The mean age of the male patients was 32.30 years (14.92) and the median was 31 years. The mean age of the female patients was 33.87 years (21.19) and the median was 32.50.

The diagnoses found in the studies investigated included the following: meniscal disorders (60.41%), ACL (22.91%), synovitis (6.25%), arthrosis (4.16%) and also osteochondritis and Baker's cyst (Table 1).

The time taken to reach the diagnosis ranged from one to 180 days, with a mean of 11.90 days (35.25) and median of 11 days.

Resection was the treatment most frequently seen in the literature, accounting for 75% of the cases, followed by embolization, with 20.83%. Among the cases studied, one was resolved using a percutaneous prosthesis and the treatment used was not specified in one other case.

The arteries most affected were the popliteal artery (45.83%) and the inferomedial genicular artery (20.83%) (Table 2).

To detect the pseudoaneurysm, complementary examinations were used, such as: echo Doppler, arteriography, computed axial tomography, angiotomy with contrast,

Table 2 – Arteries affected in the cases that were found in the literature.

Artery	Number of patients	Percentage (%)
Tibial recurrent artery	1	2.08
Superomedial genicular artery	3	6.25
Inferolateral genicular artery	3	6.25
Perforating artery of the medial gastrocnemius	2	4.16
Popliteal artery	22	45.83
Sural branch of the popliteal artery	2	4.16
Inferomedial genicular artery	10	20.83
Superolateral genicular artery	1	2.08
Descending genicular artery	2	4.16
Unspecified	2	4.16

aspiration and even inspection by means of surgery. The complementary examinations most frequently requested in the studies reviewed here were arteriography (41.66%) and echo Doppler (39.58%).

Among the 48 patients evaluated in the different studies, 34 presented pain, 29 had a pulsatile tumor, 11 had edema of the calf, eight had a non-pulsatile tumor and one had paresthesia (Table 3).

Table 3 – Signs and symptoms reported in the literature surveyed.

Signs and symptoms	Number of cases	Percentage (%)
Pain	34	36.55
Pulsatile tumor	29	31.18
Edema of the calf	11	11.82
Hemarthrosis	10	10.75
Non-pulsatile tumor	8	8.6
Paresthesia	1	1.07
Total	93	100

Discussion

Knee arthroscopy is a safe and commonly performed procedure, with few complications. The incidence rate of nerve and vascular injuries described subsequent to arthroscopy ranges from 0.56% to 0.80% in large series. This low incidence is perhaps one of the reasons why vascular complications are difficult to diagnose and are diagnosed late.⁷

The greater incidence of pseudoaneurysms found among men (75%) is due to the fact that these knee injuries occur in young people practicing sports activities, who are mostly men. However, the number of women who practice sports is growing and the ratio of injuries per hour of sports practice is lower among women.⁴⁴

The risk of arterial injury during knee surgery is related to knee anatomy, since the vessels are close to the joint capsule. During knee flexion, the arteries are moved forwards, toward the posterior capsule, and the popliteal artery is then separated from the capsule by a thin layer of fat, which may be the reason why the popliteal artery is so frequently affected. Since the posterior part of the knee is difficult to view during arthroscopy and use of a tourniquet makes it impossible to view bleeding immediately, these vascular injuries are not easily diagnosed. For this reason, the limb circulation should be carefully checked after the surgery.⁷

Rupture of the artery wall is necessary for a pseudoaneurysm to develop. However, a pseudoaneurysm may form after arthroscopy without any history of penetration of the knee capsule or vessel wall. One hypothesis for explaining this relates to the high levels of stress applied to the knee structures and arteries during the arthroscopic procedure. For example, this can be seen in arthroscopic surgery to treat injuries to the medial meniscus, in which in some cases it is necessary to use a high degree of varus force in order to achieve good viewing. Another hypothesis that is more plausible is that partial injury to the artery may occur at the time of constructing the access routes for the arthroscopy. The access portal is opened on the anteromedial and anterolateral face of the knee, close to the superior genicular arteries. There is also the access route for graft harvesting, which in the case of patellar grafts and grafts from the knee flexor tendons is close to the inferior genicular arteries.⁷

Knowledge of the vascular anatomy of the knee is essential in order to avoid this type of complication. The following arteries supply the knee joint: the genicular branches of the femoral, popliteal and anterior tibial recurrent arteries and the descending branch of the lateral circumflex femoral artery. The majority of the blood supply for both the ACL and the posterior cruciate ligament comes through ligament branches of the medial genicular artery (which also supplies the synovial membrane and the lateral margin of the menisci) and also through some terminal branches of the inferomedial and inferolateral genicular arteries. These vessels branch out to form a rich synovial plexus that contributes to a network of intracapsular vessels that surround the ACL.⁴⁵

Arthroscopic surgery that requires bone tunnels also requires the use of guides that ensure that the holes are drilled through the bones in the correct places. Tunnel construction is usually started by means of a steel wire of diameter 2 mm

(guidewire). After the surgeon has decided that the positioning is correct, a cannulated drill bit is passed along this guidewire in order to drill the bone. Here, two important points arise with regard to discussing pseudoaneurysms. The first relates to soft-tissue penetration, in that these wires are passed into the soft tissues blindly, which may lead to partial injuries to arteries. The second relates to precision, in that if poor quality materials are used, this may lead to guidewire into unplanned locations, even if the technique is applied correctly.

Pain was the commonest symptom among the cases reported, but its nonspecific nature sometimes may not have helped in making the diagnosis. Pulsatile tumors and hemarthrosis with arterial blood were present in many of the cases and their presence led to a high degree of suspicion. In some cases, the tumor was described as non-pulsatile, but none of the authors of these case studies discussed this.

The diagnosis can be made clinically through the presence of a painful pulsatile mass of growing size, in association with palpable fremitus and a systolic heart murmur. The diagnosis can be confirmed by means of echo Doppler, magnetic resonance imaging and arteriography.³⁷ The following complications of pseudoaneurysms may occur: hemorrhage, pain and space occupation effects such as neurological compression, neuralgia, venous compression and thrombosis.⁴⁶

A high degree of suspicion needs to be maintained in order to avoid delayed diagnosis. The median length of time taken to make the diagnosis was found to be 11 days, but it ranged from one day to 10 weeks after the initial procedure.³⁷

Although rare, pseudoaneurysm is a risk that is inherent to arthroscopic surgery. All patients need to be notified regarding the vascular risks, even in cases of small-sized procedures.

Conflicts of interest

The authors declare no conflicts of interest.

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