Vascular injury as a complication of knee arthroscopic surgery. Report of two cases and review of the literature

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Introduction

Vascular trauma can affect the arteries, veins or both. Several causes have been reported including the iatrogenic type with an incidence ranging from 0.56 to 8.2%.1-3 This percentage has been increasing due to the increasingly frequent use of various percutaneous approaches for minimally invasive procedures such as vascular access, access for laparoscopy, arthroscopy and endoscopy. Vascular complications of these procedures are rare and include thrombosis, vascular sections, hemorrhage, lacerations, arteriovenous fistula (AVF) and pseudoaneurysm.2 Vascular lesions caused by orthopedic surgery are attributed to factors such as direct trauma during instrumentation, traction, and fracture of the atheroma due to the ischemia. These lesions are more common in patients with a history of peripheral arterial disease and orthopedic or vascular surgery.

Knee arthroscopy is a safe surgical procedure with a relatively low percentage of complications.3 We report two cases of vascular injury secondary to arthroscopy for meniscus surgery and a review of the medical literature.

Case Reports

Two patients were seen at our service (Angiology and Vascular Surgery) with previous elective knee arthroscopy.

Case 1

We present the case of a 39-year-old male with a history of sports injury from November 2008, diagnosed as an anterior cruciate ligament injury and meniscopathy. In January 2009, he underwent minimally invasive surgery: left knee arthroscopy with synovectomy, chondroplasty, plicectomy...
and remodeling of the posterior horn of the lateral meniscus with ischemia time of 90 min at 270 mmHg. Postoperative recovery demonstrated leg edema, paresthesia and pain, as well as scant bleeding from drainage. After 24 h, the pain and swelling increased; therefore, dermofasciectomies were performed without decreasing the symptoms. In addition, the patient demonstrated pallor and distal hypothermia and showed signs of peripheral nerve damage (loss of control of forefoot) and slurring of muscle groups in the calf; 72 h after the surgical procedure he was sent for evaluation by the physicians of the Angiology Unit. During physical examination, the patient demonstrated his right lower limb with arterial and venous integrity, left pelvic limb with the absence of popliteal pulses, dorsalis pedis and posterior tibial. With the above, he was diagnosed with acute arterial insufficiency; nevertheless, the evolution time exceeded the critical point of established ischemic to avoid complications secondary to postsurgical revascularization. Despite this, a popliteal exploration was performed through a posterior and revascularization route. The findings at the time of the surgery were pseudoaneurysm thrombosis of the popliteal artery and total section of the popliteal vein with retraction of the ends and thrombosis. After arterial and venous thrombectomy and resection of the pseudoaneurysm, the patient received an inverted saphenous graft in the artery and a noninverted saphenous graft in the vein recovering distal pulses. As expected, by the time of evolution, he had reperfusion syndrome with elevated creatine phosphokinase enzymes (12,846 U) and myoglobinuria secondary to rhabdomyolysis. Measures were initiated for renal protection (forced diuresis, alkalinization of urine and use of free radical scavengers); thus, renal function was maintained within normal limits. He did not have further elevation of nitrogens; however, despite pedal pulses and subsequent posterior tibial, the extremity did not recover due to the large amount of muscle tissue lysate secondary to the ischemic time. Unfortunately, it was necessary to carry out a knee amputation. As a sequel, the patient had peripheral neuropathy with tenderness of the treated stump with neuromodulators for 3 months. He is currently undergoing rehabilitation with prosthetic use.

Case 2

We present the case of a 65-year-old female patient with controlled hypertension who was diagnosed with bilateral patellar lateralization and grade 2 patellar chondromalacia requiring knee arthroscopy. She underwent patellar release and overlapping bilateral alar. During the immediate postoperative period there was continuously oppressive pain in the left pelvic limb and increased with progressive mobilization. She also experienced edema and paresthesia. The pain increased to such a degree that it prevented ambulation. She was sent to the Angiology Unit 3 weeks after surgery with the clinical suspicion of DVT of the left leg. On admission, the left lower extremity had normal femoral pulse with murmur at this level. In the popliteal region, the fremitus palpation was intense and murmur on auscultation, distal hypothermia with prolonged capillary refill, tenderness with superficial and deep palpation, with increased perimeter of 2 cm in the thigh and 4 cm in the calf compared with the right leg. There was mass tension in the calf muscle. Duplex Doppler, contrast tomography and angiography (Figures 1-3) showed a popliteal AVF level with significant dilatation of the popliteal vein, forming a venous aneurysm sac that laterally displaces the popliteal artery. Elective surgery consisted of a primary closure of the AVF at the level of the popliteal vein and arterial resection of a segment of the popliteal vein of ~0.3 cm with end to end anastomosis (Figure 4).

Discussion

Knee arthroscopy is a very safe surgical procedure. Arthroscopic meniscectomy of the knee is the most commonly performed procedure.4 According to the Committee on Complications of the Arthroscopy Association of North America, the reported complication limits range from 0.56 to 8.2%. Of 375,069 knee arthroscopies only 12 (0.0032%) vascular lesions were reported, of which four required amputation.3,5

Few complications are associated with arthroscopy and most are located in the popliteal artery and include hem-
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To avoid these serious consequences, it is importantly vital that the surgeon take into consideration the possibility of a vascular complication, extensive knowledge of the circulation of the knee including vascular anatomic variants, and basic knowledge in vascular clinical examination (Figure 5).

Pseudoaneurysm originates after the laceration of the artery wall with the consequent affectation of the wall and separation of its layers, which allows the passage or leakage of blood into the space. It manifests as a pulsating mass near the incision or swelling (simulating a hematoma) with a progressive growth. When genicular arteries are affected, recurrent hemarthrosis is a common symptom. Most popliteal pseudoaneurysms are identified between the second and fifth month after arthroscopy. Although the majority of pseudoaneurysms have been reported in the popliteal artery, there are reports in the literature where the affected arteries are the genicular arteries because the ports that are almost always used for knee arthroscopic approach are the anteromedial and anterolateral ones (Figure 5).

When the affected artery is a geniculate branch, the diagnosis may be delayed and may be associated with neurological deficit in the peroneal nerve territory. With pseudoaneurysm, DVT can also coexist when the peroneal nerve compresses the vein and generates venous stasis and venous hypertension. Treatment options include coil embolization, endovascular stent or pseudoaneurysm resection with graft interposition, depending on the infrastructure and surgeon’s preference.

In the case of AVF, it creates a short circuit. The flux generated in this high resistance prevents communication of the distal part of the artery diverting arterial blood flow into the venous system considered to be a system of least

arthrosis, ecchymosis, hematoma, superficial infection and vascular thromboembolic disease (VTE). In isolated cases, complications such as pseudoaneurysm, amputation secondary to perforation of the popliteal artery and arthroscopic post-meniscectomy AVF have been reported. Because postarthroscopy vascular complications are infrequent, surgeons do not have a high level of suspicion and early diagnosis is not done. Late diagnostic complications include massive bleeding, permanent neurological damage, irreversible ischemia, supracondyloid amputation and, in the case of chronic AVF, heart failure secondary to right-
resistance, which results in increased venous pressure and decrease of arterial distal pressure. When there are long communications, the vein tends to expand and systemic disorders can be generated, depending on the magnitude of the flow. These may cause heart failure. According to this, patients may have different symptoms and classic signs of arterial insufficiency manifested by pain, hypothermia, distal pallor, sensory deficit and intermittent claudication or signs and symptoms of venous insufficiency manifested by edema, venous hypertension, and varicosity. In both cases they were able to auscultate a murmur and palpate a fremitus or pulsatile tumor. The treatment of choice is surgical dismantling of the AVF, although there have been reports of cases of fistulas at the level of genicular arteries with spontaneous resolution.11

Clinical diagnosis can be confirmed in the first instance with minimally invasive studies such as the duplex Doppler that gives information about the size of communication and flow. In order to plan the surgical procedure we required more studies providing more anatomic detail. Studies carried out include arteriogram, computed tomography, or magnetic resonance angiography.1

The movement of the knee (Figure 5) is made up of two arterial systems: intrinsic and extrinsic that are anastomosed. The five genicular arteries have added certain articular branches and muscle joints to form the intrinsic system, whereas the extrinsic system is formed by the descending genicular artery, a recurrent branch of the anterior tibialis and a descending branch of the femoral lateral circumflex artery.11,13

In the medical literature there are many cases that report vascular complications after an open surgery such as knee arthroplasty and osteosynthesis of fractures.14,15 The number of complication reports of this type after minimally invasive procedures such as arthroscopy and ligament reconstruction is much lower.16

Because the genicular arteries are of small caliber, it is more frequent that the lesion generated is the total section of the artery and not the partial injury; therefore, it is most often associated with hematomas and ecchymoses. Nevertheless, there are several reports in the literature where pseudoaneurysms are described in genicular arteries after the arthroscopic: four cases of pseudoaneurysms of inferior medial geniculate artery,17-20 two cases of pseudoaneurysm of the superior medial geniculate artery,9,21 and five cases in lower lateral geniculate artery.12,22-24

There were two cases in the superior lateral geniculate artery,13 one case in the recurrent tibial artery,25 one case of tibial artery,26 one case of sural artery,27 one case in the descending genicular,12 nine penetrating injuries of the popliteal artery postarthroscopy,3 and six penetrating injuries of the popliteal artery after 118,540 arthroscopies.8

In conclusion, although vascular injury during arthroscopy is an extremely rare complication (0.0032%), it should be considered a risk with potentially fatal consequences for the viability of the extremity and for the life of the patient when associated with bleeding. Emergency treatment is imperative in these cases.

When the case is a complication with late manifestations, surgical treatment depends on the type of injury, surgeon’s preference and the availability of different devices required in each technique. In the case of AVF, the primary closure of the communication and in the case of pseudoaneurysm, the elimination of the dilated vessel is the goal to reach in routes to resolve the lesion generated by the instrumentation during arthroscopy. For the appropriate diagnosis, the surgeon must keep in mind that this complication exists and must be prepared to identify the clinical picture.

References

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