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Review Article

Popliteal artery aneurysm in pediatric population: a review

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ABSTRACT

Popliteal artery aneurysm is a dilation greater than 1.5 cm in the diameter of the popliteal artery. It is a rare condition in children, which is frequently associated with connective tissue disorders or traumatic events. Clinically, it can present as a pulsating mass in the popliteal region, accompanied by pain and thrills in symptomatic cases. Diagnosis is made using Doppler ultrasound, although advanced techniques such as angiography can be used for more detailed evaluation. Management varies depending on the size and symptoms, with open surgery being the preferred treatment for aneurysms larger than 2 cm, with endovascular options reserved for specific circumstances; however, they are not recommended in young patients due to the high risk of stent rupture. Complications include thrombosis, infection, and limb loss in cases of aneurysm rupture without any corrective management.

Keywords: Popliteal artery, Aneurysm, True aneurysm, Management, Children, Pediatric

INTRODUCTION

Popliteal artery aneurysm is the presence of a dilation greater than 1.5 cm in the diameter of the popliteal artery.[1] In the pediatric population, aneurysms are a rare pathology, and their few presentations have been more frequently associated with connective tissue diseases such as Marfan and Ehler Danlos syndrome, and their association with other pathologies of vascular origin has also been reported. such as autoimmune diseases or infectious vasculitis such as Kawasaki disease. Finally, when it is not the etiology mentioned above, trauma has been associated with the presentation of popliteal artery aneurysm in the pediatric population.[2] It is known that the etiology is due to a combination of genetic alterations which generate multiple inflammatory processes as a consequence.[3] Sarkar et al carried out a classification in which aneurysms in the pediatric population were described according to their clinicopathological characteristics, which they number 1-9 (Table 1).[4]

These aneurysms can be asymptomatic or present as pulsating masses located in the popliteal region. In addition, thrills and local pain may occur in these masses. Its diagnosis should be focused on clinical examination of the patient and with the help of images such as Doppler echo, being diagnostic aid of choice. However, usefulness of other aids such as angiography, CT angiography or magnetic nuclear resonance angiography has been described, which can more accurately determine diameter of aneurysm to guide its management.[5] Among the complications of peripheral aneurysms such as that of

popliteal artery, thrombosis is most frequently found, and rupture has also been described. The management of a popliteal artery aneurysm will consist of conservative measures along with surgical intervention, latter of which will be indicated in those patients who present a dilation greater than 2 cm due to their high risk of complications. Surgical procedures include open, endovascular management and intra-arterial thrombolysis therapy. Most recommended and preferred management is open.[3]

Table 1: Clinicopathological classification of aneurysm in the pediatric population.

Classification	Characteristic
1	Arterial infection
2	Giant cell aortoarteritis
3	Autoimmune connective tissue disease
4	Kawasaki disease
5	Ehler-Danlos or Marfan syndrome
6	Other degenerative forms of non-inflammatory origin
7	Arterial dysplasia
8	Congenital-idiopathic factors
9	Pseudoaneurysm associated with injury due to extravascular events.

EPIDEMIOLOGY

The presentation of popliteal artery aneurysm among the pediatric population is not frequent. It is estimated that it has a prevalence of 1%. Most of them are associated with traumatic, inflammatory events or degenerative diseases.[6]

CLINICAL MANIFESTATIONS

Around 37% of patients who present with this pathology are asymptomatic, and their discovery is made through palpation of mass/ USG examination. However, in those cases of symptomatic symptoms, presence of pulsatile mass has been reported. located in the popliteal fossa of affected lower limb, which can sometimes be accompanied by pain and thrill.[1] In those cases where the aneurysm is large, symptoms associated with compression of adjacent structures have been reported, such as paresthesia in case of nerve compression/ venous thrombosis in case of venous compression (Figure 1).[7]

In the case of patients with venous thrombosis of the affected lower limb, edema, pain, heaviness of the extremities, and cramps will frequently be found.[8]

The most frequent complications are ischemia and rupture. However, they are rare. In the case of a ruptured aneurysm, the diagnosis is not easy, since its presentation is infrequent, an incidence of 2.1-2.6% has been reported. However, it presents very marked symptoms such as ischemia, edema, anemia and 100% risk of loss of the limb if the rupture is not treated.[7]

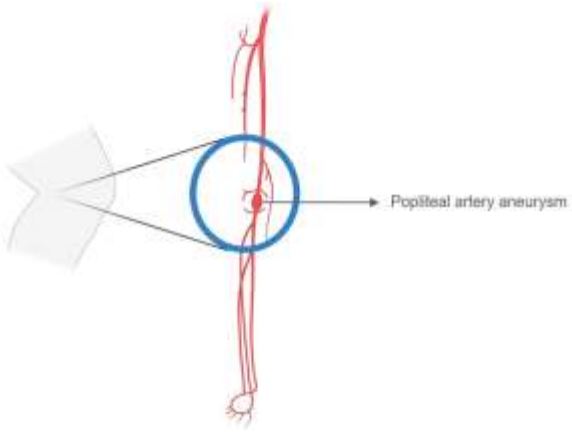

Figure 1: Popliteal artery aneurysm.

PSEUDOANEURYSM DUE TO TRAUMA

The pseudoaneurysm, also known as false aneurysm, refers to the dilation of the blood vessel as a consequence of the formation of a hematoma that is contained by the adjacent vascular tissues, among which are mainly the media and the adventitia, this as a consequence of processes inflammatory, traumatic or iatrogenic.[9] In the pediatric population, although they are infrequent, there have been multiple reports of patients with pseudoaneurysms due to puncture. This has possibly been related to the difficulty generated by puncture in smaller vessels and the technique required, since a lack of anatomical understanding could lead to performing a technique that is harmful to the patient. Among the management of choice, ultrasound-guided compression, application of thrombin by injection and surgical management have been described. The most recommended initial approach for pediatric patients is surgical intervention except for those patients who present stability of the pseudoaneurysm in which conservative management will be the choice.[10] Most pseudoaneurysms do not present symptoms. However, in those cases where symptoms are present, it is common to find the presence of a pulsatile mass in the affected region or its complications that could produce symptoms such as thrombosis, rupture, ischemia or hemorrhage. Usually, the image of choice is color Doppler ultrasound where it is common to find the Yin-Yang sign, which represents a bidirectional flow in the image. Additionally, in the neck of the pseudoaneurysm it is common to find anterograde and retrograde flow.[11]

PERSISTENT SCIATIC ARTERY

The sciatic artery originates during the embryogenesis of the umbilical artery and during the first weeks of pregnancy it will be the main person in charge of supplying irrigation to the lower limb, until the superficial femoral artery appears to replace its function.[12] In patients with a persistent sciatic artery, it is considered an anatomical variation due to the lack of development of the femoral artery and the involution of

the sciatic artery generating aneurysmal degeneration of the vessel, which is rare. Around 40% of patients are asymptomatic and 50% of patients could present symptoms associated with acute ischemia of the lower limbs or pulsatile mass at the level of the buttock. It was described that the persistence of the sciatic artery is complete in those patients where the main supplier of blood to the lower limb originates from a junction with the popliteal artery and was determined to be incomplete when an interruption is found before reaching the popliteal artery and the superficial femoral artery and the latter is the main one in charge of irrigation in the lower limb (Figure 2).[13] Angiography is the gold standard for making an adequate diagnosis of the presence of a sciatic artery and surgical management through percutaneous transluminal balloon angioplasty with or without a stent has been frequently reported. In those cases of patients with asymptomatic clinical presentation, surgical intervention was not required. However, it is of great importance to carry out continuous monitoring to avoid complications and subsequent loss of the affected limb. For those patients with symptomatic clinical presentation, surgical or endovascular management will be the one of choice and surgical management will gain even more weight in patients who already have signs of ischemic complications.[14]

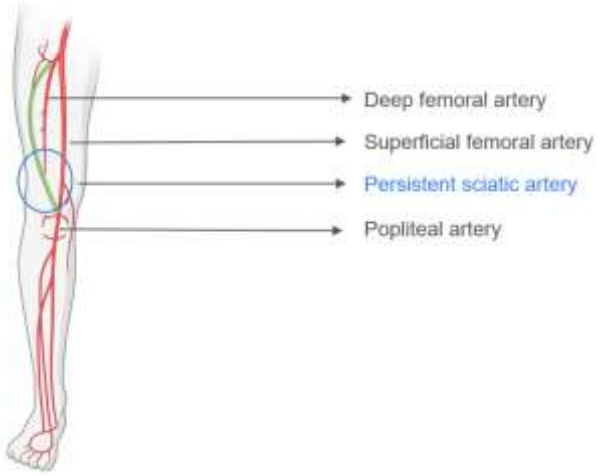

Figure 2: Persistent sciatic artery.

DIAGNOSIS

The initial diagnosis should be made based on clinical suspicion upon examination of the patient. Once there is suspicion, the gold standard for the first imaging diagnosis is Duplex ultrasound. In which a dilation of the popliteal artery is observed with a diameter greater than 1.5 cm, additionally a mural thrombosis could be found that could be observed as heterogeneous intraluminal echoes, and a residual lumen diameter could be noted.[15] The usefulness of angiotomography has also been described, which could provide information for surgical intervention and give information such as muscle aberrance and the anatomical relationship of the popliteal artery with the different adjacent structures. Other conditions could be observed through the tomography such as the presence of a cyst, arterial thrombosis, occlusion or stenosis of the popliteal artery.[9,16]

TREATMENT

The management of popliteal artery aneurysm focuses mainly on the prevention of complications, with surgical management being the one of choice in those patients with a diameter greater than 2 cm of the aneurysm or symptomatic clinical picture. Surgical management can have different approaches, among which is repair by open surgery or endovascular management. The gold standard being the open surgical approach. The open approach can be performed in 2 different methods. The medial approach is the most used by surgeons and in which the patient is positioned in the supine position and allows greater access to the saphenous vein and bypass the popliteal artery. Another open surgical method is the posterior approach where the patient is positioned prone. This approach is used more frequently in cases where the aneurysm generates a compressive effect due to its size or in those cases where the aneurysm is smaller. Post-surgical complications have been reported in up to 20%, the most frequent being infection, hematomas and thrombosis.[17,18] Endovascular management is performed through percutaneous access of the common femoral artery or the superficial femoral artery. After access, the anatomy of the artery will be defined by means of an angiogram. Finally, the artery will be covered with the use of a stent. Despite its effectiveness and efficacy in the short and medium term, it is not recommended in pediatric patients who are very active with repeated knee flexion during the day, due to the high risk of stent fracture.[19]

CONCLUSION

Popliteal artery aneurysm in the pediatric population is a rare pathology usually associated with connective tissue disorders or traumatic events. Early diagnosis using Doppler ultrasound is crucial for the prevention of serious complications such as thrombosis or rupture. The optimal management of the aneurysm depends on the diameter and symptoms. The open surgical approach being the preferred choice.

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