Case Report and Review of the Literature

Superficial Femoral Artery Pseudoaneurysm Secondary to a Femoral Osteochondroma: A Case Report and Review of the Literature

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ARTICLE INFO

Article history:
Received: 18 May, 2020
Accepted: 3 June, 2020
Published: 15 June, 2020

Keywords:
Pseudoaneurysm
femoral artery pseudoaneurysm
osteochondroma
exostosis

ABSTRACT

Background: Osteochondromas or Osteocartilaginous Exostosis are cartilage-capped bony growths arising from external bone surfaces. They typically occur at the level of growth plates and account for 30% of benign bone tumors. Vascular complications from osteochondromas are rare with roughly 112 reported cases in the literature dating back as early as 1953. Vascular injuries are location dependent, with popliteal pseudoaneurysms being the most prevalent. The operative techniques to repair these injuries have varied over time and are related to the location, degree of vascular injury, presence of thrombosis or infection and involvement of nearby structures like named veins or nerves. We present a case of a superficial femoral artery (SFA) injury secondary to an osteochondroma and offer a review of the literature evaluating the trends on operative repairs and their association with the degree of vascular injury.

Methods: A total of 112 publications were found and independently reviewed. Articles containing age, sex, presentation, size of the aneurysm and surgical technique for repair were included for evaluation. Mean follow up, use of anticoagulation, and whether there was associated trauma was also recorded if reported by the authors. Articles with insufficient reported variables were excluded. A total of 49 publications were selected for evaluation based on these criteria. The review of literature was performed through PubMed, MEDLINE, NCBI using the words “pseudoaneurysm”, ‘superficial femoral artery”, “popliteal artery”, and “osteochondroma”.

Results: Young Males were the most prevalent group (79.4%) with a mean age of 21.4 years of age. The most common complaint at presentation was pain and a palpable mass (81%) with no history of trauma (51%). Popliteal aneurysms (85%) were the most common vascular injury while the average size of injury was 5 mm. Operative techniques included arterioplasty (30.6%), end to end anastomosis (20.4%), greater saphenous vein (GSV) patch (20.4%) GSV bypass (8.1%) GSV interposition graft (8.1%) and xenopericardial or polytetrafluoroethylene (PTFE) patch (2%). Smaller arterial injuries (<5 mm) were most commonly managed with arterioplasty or end-to-end anastomosis.

Conclusion: Vascular injuries secondary to osteochondromas are rare. High suspicion and prompt diagnosis are necessary to prevent long-term sequelae from neurovascular compromise. Smaller arterial defects appear to be best suitable for primary reconstruction either by arterioplasty or aneurysmectomy with end-to-end anastomosis. Ultimately, the surgical reconstruction needs to be guided in a case-by-case basis.

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Introduction

Osteochondromas (Osteocartilaginous Exostosis) are cartilage-capped bony growths arising from external bone surfaces typically seen at the level of growth plates. They are commonly seen as spontaneous isolated bony masses commonly affecting long bones. There are documented cases of isolated tumors arising in patient who had previously received radiotherapy [1]. Furthermore, conditions like Hereditary Multiple

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Osteochondromas (HMO) and Hereditary Multiple Exostoses (HME) are inherited diseases characterized by the presence of two or more osteochon-
droma. These diseases are secondary to an autosomal dominant mutation in tumor suppressor genes EXT1 or EXT2 [2, 3].

Most asymptomatic osteochondromas go undetected while others may be incidentally found on imaging completed for a variety of other reasons. Asymptomatic osteochondromas can be treated with close observation. On the other hand, symptomatic osteochondromas may present as painful masses with limitations in range of motion, tissue deformities, or pathologic fractures [4]. They are typically diagnosed base on history, physical examination, and radiographic findings. Frequently, patients report their symptoms being preceded by a traumatic event or vigorous activity [5, 6].

If a complex osteochondroma is suspected, computerized tomography (CT) or magnetic resonance imaging (MRI) may be necessary to better characterize these lesions [1]. Furthermore, when an associated vascular injury is suspected, the use of duplex ultrasonography, CT angiography (CTA), magnetic resonance angiography (MRA), or endovascular angiography can be employed to better characterize these lesions. These imaging modalities can demonstrate the anatomic relationship of the vascular defect with the surrounding structures, which can be helpful for operative planning [2, 7]. Interestingly, there are only six previously reported cases of an osteochondroma causing an injury to the superficial femoral artery (SFA). We present a case of a patient with an SFA injury related to an adjacent osteochondroma and our surgical approach to repairing the involved vessel.

Methods

A literature review through PubMed, MEDLINE, and NCBI was performed using the key words “pseudoaneurysm”, “superficial femoral artery”, “popliteal artery”, and “osteochondroma”. A total of 112 publications were found. An Independent review of the articles for the following variables was completed: patient age, sex, size of the aneurysm, history of trauma, use of anticoagulation, and the surgical technique used for repair. 63 of the 112 articles did not contain at least one of the above variables and were excluded. A total of 49 publications were selected for evaluation based on these criteria.

Case Presentation

Our patient is a previously healthy 17-year-old male who presented to the emergency department complaining of worsening left lower extremity swelling, paresthesia and gait instability that began after a presumed hamstring injury one month prior to presentation. His initial physical examination was significant for a localized non-pulsatile soft tissue swelling over the medial aspect of the left thigh (Figure 1), decreased pedal pulses on the left, and decreased sensation to light touch in the mid to distal shin. A CTA showed an 11.9 x 8.4 x 9.4 cm SFA pseudoaneurysm adjacent to a distal femoral osteochondroma (Figure 2).

The patient was taken to the operating room for urgent repair. A tourniquet was placed on the proximal thigh following distal venous drainage with an Esmarch’s bandage. A longitudinal incision was made along the medial aspect of the thigh where a large hematoma was encountered upon retraction of the adductor muscle. The hematoma was evacuated and the distal SFA was exposed. Upon closer inspection of the vessel, a 3-4 mm traumatic arterial wall defect was noted to be in perfect alignment with a contralateral sharp tipped osteochondroma (Figure 3).
A primary closure with 6-0 prolene sutures in an interrupted fashion was conducted. Immediately following the repair vascular flow was reinstituted by releasing the proximal clamp. There was immediate clinical evidence of distal perfusion, which was confirmed with intraoperative Doppler evaluation. The orthopaedic surgery team was called and was able to successfully excise the osteochondroma. The patient’s post-operative course was unremarkable, and he was discharged home on the third post-operative day with outpatient physical therapy and no antiplatelet therapy or anticoagulation. The patient was evaluated 3 weeks after his surgery and was noted to be symptom free with intact distal perfusion.

**Discussion**

Vascular complications from osteochondromas are quite rare. However, vascular damage can occur with direct contact between the vessel wall and a growing osteochondroma. In these cases, histological studies show chronic scarring of the media with smooth muscle cell loss, fragmentation, and loss of the internal elastic lamina [3]. Given the histological pattern described above and the usual location of these bony lesions it is not surprising that popliteal artery pseudoaneurysm is the most common vascular injury associated with osteochondromas. Furthermore, this vessel’s fixed position between Hunter's canal superiorly and the popliteal muscle inferiorly makes it even more prone to this type of extrinsic injury with pseudoaneurysm formation [4, 8].

These pseudoaneurysms are most commonly seen in men (79.6% in our review vs 20.4% in females) and typically result from a distal femoral or proximal tibia osteochondroma [4, 7, 8]. The most common complaint at presentation was pain and a palpable mass (81%) with no history of trauma (51%). Popliteal aneurysms (85%) were the most common vascular injury. SFA lesions, like the one presented here, are exceedingly rare due to the classically distal location of osteochondromas around the bony growth plate. We hypothesize that our patient had a rapidly growing bony lesion in an unusually proximal location, which contributed to a localized arterial injury that lacked the chronic aneurysmal changes classically seen in this injury pattern. Surgical treatment usually includes aneurysmectomy and reconstruction of the remaining vascular defect. Common reconstruction options including end to end anastomosis, greater saphenous vein (GSV) patch, GSV interposition graft, or bypassing the lesion [4, 5, 7-9]. In our review, the most common surgical techniques employed were arterioplasty (30.6%) followed by end-to-end anastomosis (20.4%), and GSV patch (20.4%). The average size of the arterial defect where arterioplasty was used was 5 mm. Aneurysmectomy and end to end anastomosis was seen with an average defect size of 5.6 mm. GSV patches were seen with an average defect size of 20 mm or more. This suggests that smaller arterial defects are amenable for less technically complex repairs while larger defects might require more complex surgical approaches and the use of prosthetic grafts (Table 1). Of all the cases reported only 6.1% were administered anticoagulants.

**Table 1:** Summary of cases reported in the literature with location, greater diameter dimension of aneurysm and size of arterial wall defect.

| Author             | Age | Sex | Location       | Aneurysm Diameter (mm) | Symptoms                  | Injury size (mm) | Surgical repair             |
|--------------------|-----|-----|----------------|-------------------------|--------------------------|-----------------|----------------------------|
| Sakata et al       | 16  | M   | Popliteal      | 6.5                     | Pain and paresthesia     | 15              | GSV patch                  |
| Baptista et al     | 15  | M   | Popliteal      | N/S                     | Painful mass             | N/S             | Arterioplasty              |
| Takahashi et al    | 48  | F   | Popliteal      | 10                      | Painful mass             | 1               | End to end anastomosis     |
| Takahashi et al    | 28  | F   | Popliteal      | 6                       | Pain                     | 2               | Arterioplasty              |
| Hirotaka           | 15  | M   | Popliteal      | 5                       | Pain                     | 2               | GSV patch                  |
| Taneda et al       | 49  | M   | Popliteal      | 9                       | Painful mass             | 8               | End to end anastomosis     |
| Perez-burkhart et al | 14  | M   | Popliteal      | 6                       | Painful mass             | 1               | Arterioplasty              |
| Guder et al        | 22  | F   | Popliteal      | N/S                     | Mass                      | 2               | Arterioplasty              |
| Ruales romero et al | 18  | M   | Popliteal      | 7.8                     | Painful mass             | 3               | GSV patch                  |
| Vanhegan et al     | 21  | M   | Popliteal      | N/S                     | Painful mass             | N/S             | GSV bypass                 |
| Davies et al       | 18  | M   | Popliteal      | 10                      | Painful mass             | 15              | GSV patch                  |

_Surgical Case Reports_ doi: 10.31487/j.SCR.2020.06.19

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Pellenc et al.\(^{21}\) M Popliteal N/S Painful mass 15 End to end anastomosis

Doganci et al.\(^{21}\) M Popliteal 18 Painful mass N/S Arterioplasty

Onan et al.\(^{12}\) M Popliteal 10 Painful mass N/S End to end anastomosis

Choi et al.\(^{12}\) M Popliteal 13 Painful mass N/S N/S

Syed et al.\(^{35}\) F Popliteal 9.6 Swelling 6 PTFE patch

Argin et al.\(^{14}\) M Popliteal N/S Swelling N/S N/S

Al-Hadidiyy et al.\(^{23}\) M Popliteal N/S Painful mass N/S GSV patch

Taneda et al.\(^{49}\) M Popliteal 9 Asymptomatic 8 End to end anastomosis

Bhalla et al.\(^{10}\) M Popliteal 4 Mass 3 End to end anastomosis

Bakkali et al.\(^{20}\) F Popliteal 8.3 Painful mass N/S End to end anastomosis

Ballardo et al.\(^{33}\) M Popliteal 4 Painful mass N/S GSV patch

Scott et al.\(^{37}\) F Popliteal 6 Painful mass N/S GSV bypass

Osborn et al.\(^{16}\) M Popliteal 5 Painful mass N/S GSV patch

Busrsztyn et al.\(^{12}\) M Popliteal 6 Painful mass 1.5 GSV bypass

Goyal et al.\(^{21}\) M SFA N/S Pain and paresthesia N/S Fem-pop bypass

Manghat et al.\(^{21}\) M Popliteal 7 Painful mass 1.5 Arterioplasty

Papacharalampous et al.\(^{19}\) M SFA 7.5 Mass N/S GSV graft end-end

Legget et al.\(^{20}\) M Popliteal 5 Painful mass 4 End to end anastomosis

Oxenius et al.\(^{13}\) M Popliteal 10 Painful mass N/S Xenopericardial patch

Klebuc et al.\(^{15}\) M Popliteal 8 Painful mass 10 Arterioplasty

Nasr et al.\(^{17}\) M Popliteal 7 Painful mass N/S End to end anastomosis

Nasr et al.\(^{17}\) M SFA N/S Painful mass N/S GSV bypass

Matsushita et al.\(^{13}\) M Popliteal 5 Painful mass 5 GSV patch

Pingsterhaus et al.\(^{13}\) M Popliteal 7 Painful mass N/S GSV graft end-end

Zarra et al.\(^{9}\) M Popliteal 5 Painful mass 1 Arterioplasty

Forbes et al.\(^{30}\) M Popliteal 5 Painful mass 2 GSV patch

Predrag et al.\(^{14}\) F Popliteal N/S Painful mass N/S Arterioplasty

Gomez-reino et al.\(^{58}\) M Popliteal 2.7 Painful mass N/S End to end anastomosis

Chamlou et al.\(^{21}\) M Popliteal 2.1 Painful mass N/S Arterioplasty

Lizama et al.\(^{16}\) M Popliteal 10 Painful mass 3 GSV graft end-end

Solhaugh et al.\(^{17}\) M SFA 5 Painful mass N/S Arterioplasty

Enarker et al.\(^{20}\) F Popliteal 4 Painful mass N/S Arterioplasty

Manner et al.\(^{13}\) M Popliteal 3 Painful mass 5 Arterioplasty

Recht et al.\(^{23}\) F Popliteal 5 Painful mass N/S Arterioplasty

Hershey et al.\(^{15}\) M Popliteal 7 Painful mass N/S Arterioplasty

Blazic et al.\(^{14}\) M SFA 6 Pain and swelling 5 GSV patch

Aouini et al.\(^{52}\) F SFA N/S Paresthesia, mass and swelling N/S Arterioplasty

Woolson et al.\(^{13}\) M SFA 3.5 Painful mass 4 GSV graft end-end

N/S: Not specified; GSV: greater saphenous vein.

Only 9 publications reported long-term follow up, which ranged from 3 months to 50 months for the longest follow up reported. Long-term outcomes are difficult to assess based on the available data in the published studies. All reported cases had an uneventful post-operative course with good neurovascular recovery, even in cases that had neurologic and motor compromise at the time of presentation [1-5, 7, 8, 10, 11].

**Conclusion**

Vascular injuries secondary to osteochondromas are exceedingly rare. High suspicion, early diagnosis, and prompt surgical intervention is necessary to prevent long-term sequelae of vascular insufficiency. Lack of long-term follow up limits our ability to conclude on an optimal choice for surgical repair though smaller arterial defects appear to be best suitable for primary reconstruction either by arterioplasty or aneurysmectomy with end-to-end anastomosis. Ultimately, the surgical
reconstruction needs to be guided by the degree of vascular injury on a case-by-case basis.

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