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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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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.

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 osteochondroma. 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).

Figure 1: A) Preoperative image demonstrating a deformed left lower extremity with medial swelling and palpable mass. **B**) Lateral knee X-ray (image limited due to the patients decreased range of motion) shows several exostoses involving the proximal tibia and fibula as well as the distal femur (white arrows). Adjacent to a supracondylar exostosis, there is a large soft tissue mass surrounded by a fine hypodense line (dotted oval). **C)** Axial CTA of the lower extremities demonstrating a large pseudoaneurysm homogeneously filled with contrast on the anterior surface of the distal left SFA (red arrow).

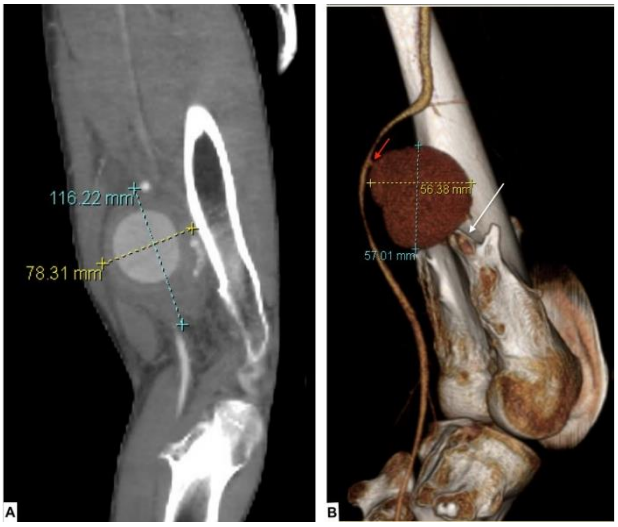

Figure 2: A) CTA MIP and **B)** 3D reconstructions. **A)** Measurements of the entire pseudoaneurysm (11.6 x 7.8 cm) with a central contrast filled portion representing active extravasation and a non-filling peripheral portion representing a hematoma. **B)** CTA 3D marks the measurement of the active part of the pseudoaneurysm on the anterior surface of the left SFA. It has a narrow neck (red arrow) and it is adjacent to a sharp-ended (white arrow) osteochondroma arising from the medial supracondylar line.

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.

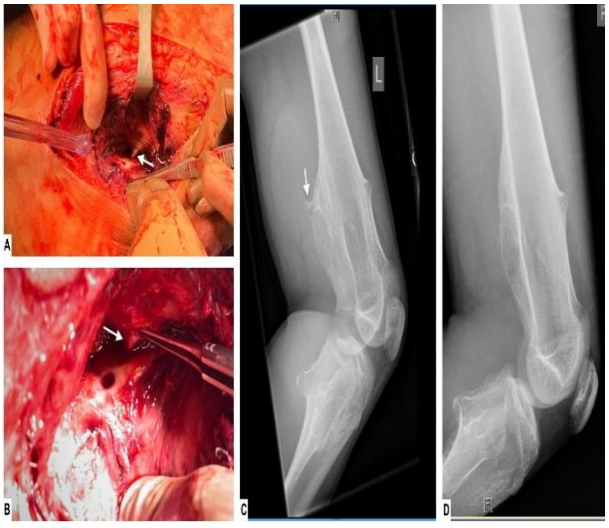

Figure 3: (A & B) Intraoperative Pictures demonstrating a sharp tipped osteochondroma (arrow) aligning with an anterior traumatic arteriotomy of the left SFA (arrow). **(C & D)** Preoperative and postoperative comparative plain films following partial resection of the posterior femoral osteochondroma (arrow).

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	Aneurysm 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

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-Hadidiy *et al*	16	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*	17	M	Popliteal	7	Painful mass	1.5	Arterioplasty
Papacharalampous *et el*	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
Zarza *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
Ennker *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 sequalae 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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