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Cover Page Footnote

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Endovascular Management of Post Traumatic Lower Extremity Pseudoaneurysm: An Evidence Based Case Report

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Abstract

In the management of posttraumatic pseudoaneurysm, the endovascular surgery, referred to as the alternative method for those who are not suitable for open surgery or conservative technique, showed good results.

Keywords: endovascular surgery, posttraumatic, pseudoaneurysm

Introduction

Posttraumatic pseudoaneurysm found following penetrating injuries, fractures, and high impact blunt trauma; but may be iatrogenic ones, such procedures in orthopedic surgery, infectious, or following tumors close to blood vessels.¹ Traumatic case commonly found in younger than those of iatrogenic.² The most common injured lower extremity arterial wall occurs in the popliteal-, common femoral-, superficial femoral-, and anterior tibial arteries.³ This pseudoaneurysm may occur within days to months following trauma, which initially recognized as a hematoma.⁴ The mechanism of injury is traction of the vessels that fixed to long bones.⁵ The pseudoaneurysm formation close related to organization of the hematoma,⁶ with increase of arterial pressure increases the pseudoaneurysm getting larger; clinically found as a pulsatile mass.⁴

Doppler ultrasound provide a 94% sensitivity and 97% specificity in diagnosis of posttraumatic pseudoaneurysm.⁷ Computerized tomography (CT) angiography confirms the diagnosis with 90% sensitivity and 100% specificity in traumatic extremities.⁸ However, the gold standard diagnostic is angiography with accuracy of 98%, and become a part of definitive endovascular repair.⁹

The treatment comprises a spectrum from: 1. conservative treatment such as ultrasound-guided compression therapy;¹⁰ 2. invasive surgery with excision or ligation; 3. non-invasive endovascular procedure, such as endograft implantation or coil embolization.¹¹ The advances in non-invasive endovascular therapy develop rapidly. With the significant achievement reduction of morbidity and mortality of pseudoaneurysm.¹² Study of De Troia et al., showed a reduction of amputation of posttraumatic pseudoaneurysm treated with invasive surgery to nil,⁴ as the endovascular procedures reduced dissection of traumatic tissues and the risk of infection.⁴ While as the infection rate following revascularization of posttraumatic lower extremity up to 11.1-52.7%,¹³ vascular injuries in the endovascular procedure may be limb-

threatening, leading to amputation. Any delay in diagnostic correlates to complications. However, complications including pseudoaneurysm rupture, thrombus formation followed by distal emboli, and compartment syndrome following pseudoaneurysm expansion lead the compression to adjacent structures.¹⁴ We report a case treated endovascular treatment and discussed the aspects of treatment in accordance to evidence-based literature.

Case illustration

Male, 18 years old presented in the Emergency Room (ER) of dr. Cipto Mangunkusumo General Hospital (RSCM) with bleed of his wound in the right leg. He had a traffic accident twenty days before admission, his motorcycle crashed, and he got his leg pinned. His wound sutured in the clinic. In the last six days, despite pain and edema, bleed ooze from the wound. Pressure bandage and stitch removal carried out, and the bleed stops temporarily. In the last three days, the edema worsens, and the oozing remains.



Figure 1. Clinical picture of the patient

On the physical examination, we found a mass on the anterolateral region of the right leg, a pulsation felt on the palpation; no active bleeding. Pulsation of right femoral- and popliteal artery ++, the right posterior tibial and dorsal pedis artery +.

CT angiograph showing a sac shaped vascular lesion measuring 3.3 x 2.8 x 3.3 cm of the proximal segment of right anterior tibial artery suggesting a pseudoaneurysm.

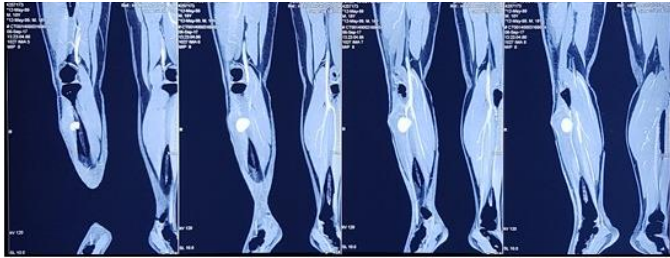


Figure 2. CT angiograph showing pseudoaneurysm of right anterior tibial artery

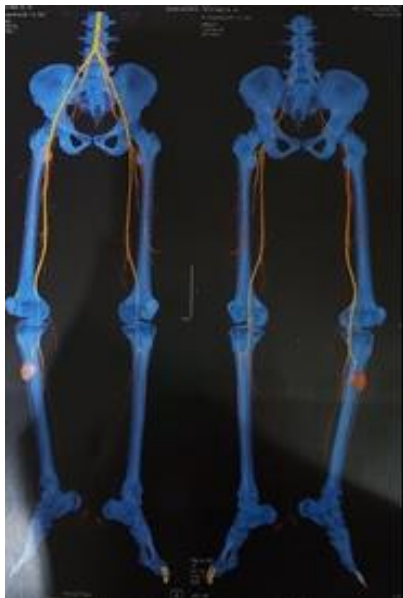


Figure 3. CT angiograph (3D) showing pseudoaneurysm of right anterior tibial artery

With the diagnose of anterior tibial artery aneurysm, the arteriography and coil embolization proceeded. Intraoperatively, a guidewire sheath Fr. 6 inserted to the left common femoral artery with ultrasound guiding. The arteriography of common femoral carried out until trifurcation. The right anterior tibial artery pseudoaneurysm visualized. The angiography proceeded and the coiling released within the pseudoaneurysm.

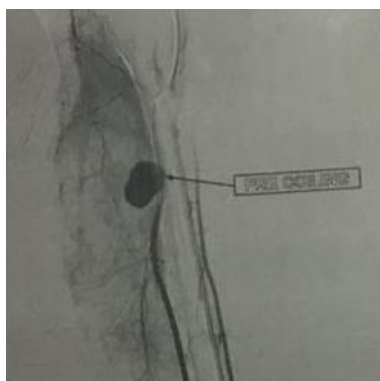


Figure 4. Angiograph of right anterior tibial artery pseudoaneurysm pre-coiling



Figure 5. Angiograph of right anterior tibial artery pseudoaneurysm post-coiling

Four weeks after surgery, the edema remains, and bleed ooze from the wound. The procedure of angiography and coiling proceeded. The evaluation showed the right posterior tibial artery found a low flow within the pseudoaneurysm, meanwhile the flow in proximal and distal clear. After the procedure, the bleeding occurred in the following two weeks. During the procedure of angiography and embolization, we found thrombus filled the pseudoaneurysm. As the wire unable to introduce, open surgery carried out. We open the sac and found 20 mL clots and coil. The source of bleeding comes from the anterior tibial artery with a diameter of 0.5 cm, pulsatile. The patching carried out with peripheral vein and sutured.

Discussion

Pseudoaneurysm referred to a vascular abnormality that infrequently reported to have an association with bones fracture, blunt or penetrating trauma, and exercises.¹⁵ In common, the subjects with pseudoaneurysm complain of pain, edema, and enlarging pulsatile lump.⁴ Such a condition may be found along with the artery-venous fistula formation, ischemia of the distal segment, or rupture of involved blood vessels.^{4,16} Should it not properly managed, it may rupture, promote thrombus formation and emboli of the distal, compressing the adjacent structures, and compartment syndrome.

Before the era of endovascular techniques, the treatment comprised of arterial ligation or reconstruction with autologous materials, external compression, coil embolization, or thrombin injection with ultrasound guiding. The standard treatment for pseudoaneurysm is open surgery with simple ligation or vein graft interposition.^{15,4} The use of stent graft for the treatment of carotid-, aorta, subclavian-, iliac-, brachial, and femoral arteries injuries is commonly reported. Although, the use for tibial artery remains limited as the small-sized stent graft unavailable. The author searched the literature regarding the efficacy and complication of endovascular procedures for pseudoaneurysm. That might be found compared with the open surgical technique.

Spirito et al. (2007) reported the successful treatment of posttraumatic pseudoaneurysm (blunt trauma) in a patient of 74 years old. Diagnosis instituted using CT scan and angiography. They employed the endovascular intervention with local anesthesia. Stent polytetrafluoroethylene of 4mm x 26mm sized inserted to the artery-venous fistula location and pseudoaneurysm. Five hundred units of unfractionated heparin. Repeated angiography showed a good result after a year follow up.¹⁵

De Troia et al. (2014) reported the treatment of a 34 years old male with pseudoaneurysm following trauma. The pseudoaneurysm in the distal third of the posterior tibial artery confirmed by duplex scan ultrasonography, measuring 31x26 mm. A dual antiplatelet therapy administered, namely cardiaspirin and clopidogrel. A 3x19 mm sized expanded polytetrafluoroethylene coronary stent graft was used. The angiography confirmed the patent posterior tibial artery. The dual antiplatelet treatment continued for twelve months. Follow up in 18 months showing triphasic tibial waveforms.⁴

Joglar et al. (2015) reported pseudoaneurysm inpatient of 39 years three weeks after trauma. The ultrasound duplex showed pseudoaneurysm in the mid-posterior tibial artery. The first attempt of ultrasound-guided compression failed as the short neck of the pseudoaneurysm. A balloon stent-graft sized 3x19 mm expanded with fluoroscopy proceeded. The angiography confirmed the complete obliteration of the pseudoaneurysm. Following the procedure, the vasospasm occurred and treated with nitroglycerin and papaverine intra-arterial injection. Ankle-brachial index 1.05, symptom-free, and triphasic tibial waveforms found in eight months follow up. Aspirin and clopidogrel continued for twelve months.¹⁶

Marks et al. (2011) reported the management of pseudoaneurysm in eight days following an open wound's debridement, intramedullary pen insertion, and fasciotomy for a gunshot injury a 19 years old male. Subject experiencing persistent pain along with paresthesia in their lower extremity. CT angiogram confirms a pseudoaneurysm in the left tibio-peroneal artery, measuring 5x16x120 mm. The evacuation of hematoma, and aspirin and clopidogrel therapy constituted.¹⁷

Jones et al. (2016) reporting the management of a 52 years old female with a pulsatile mass on the anterior left lower leg compartment. Such a condition found a week following the removal of internal fixation for a tibial fracture. CT angiography confirmed the pseudoaneurysm measuring 18x2.5x3.8 cm in the proximal anterior tibial artery. In a relatively short postoperative day, the minimal invasive referred to the method of choice. An endovascular intervention proceeded through the common femoral artery, and the patency to the distal confirmed by the angiogram. Dual antiplatelet and twelve months follow up showed normal perfusion.¹⁸

The use of stent in intravascular control may prevent multiple surgical incisions that required for ensuring proximal and distal control to maintain adequate blood flow to the distal segments. Avoiding extensive dissection on an area without scar tissue and distorted blood vessel tissues also facilitate a minimal hematoma evacuation approach post-endovascular procedure. The technique enables swift vascular control and may be performed under local anesthesia in an OR with the endovascular facility.¹⁸

The open surgical technique for pseudoaneurysm is a traditional treatment of choice. It consists of primary anastomosis or ligation and interposition graft with a saphenous vein. The procedure should be adjusted to the patient's comorbidities, vascular state, and whether there was blood vessel access on the side with an aneurysm. Both procedures may return arterial blood flow to the lower extremities. Despite that, primary resection and anastomosis may only be performed on a small and clean tibial artery aneurysm. The ligation technique was the third surgical choice and may only be performed if the posterior tibial artery is patent up to the ends of the feet.^{12,19}

Amiri et al. (2016) reported a 20 years old male with pseudoaneurysm on the posterior malleolus medial. Duplex ultrasound confirmed the pseudoaneurysm in posterior tibial artery sized 4 cm. The enlarging size was requiring the surgical intervention that was excision and primary artery reconstruction. The aneurysm has a short neck with an irregular margin, and the pathological artery resected about 2 cm, then anastomosed. Aspirin administered for 90 days following surgery. No postsurgical complication nor the sequel.²⁰

Lie et al (2017) reporting the pseudoaneurysm that found four years following total arthroplasty of the left knee in a 69 years old female. Duplex ultrasound showed a pseudoaneurysm of the anterior tibial artery with the length and width of 6.5 x 7 cm. Impossible to insert endovascular stent or embolization, then the open ligation performed. The lateral side of anterior lower limb compartment approach proceeded to access distal anterior tibial artery. The follow up on the first, second, and eleventh months showed good results.¹⁹

The open surgery technique shows some benefits compared to endovascular techniques. There are lower cost and shorter use of antiplatelet. In contrast, the open surgery technique followed by some complications. There are the risks related to general anesthesia, bleeding, wound infection, lymphocele formation, radiculopathy, prolonged healing time, perioperative myocardium infarct, and death.

There was a paradigm shift in the treatment of pseudoaneurysms; the invasive method shifted to non-invasive ones. However, the open surgical technique remains an essential role in pseudoaneurysm. Particularly those with local mass effect complications such as ischemia and neuropathy, infected pseudoaneurysm, and cases in which non-invasive techniques met with failure.^{12,20}

The lesson learned from these reports, endovascular intervention provides good results in the management of posttraumatic pseudoaneurysm. A shorter length of stay of reported by Joglar et al. (2015), all reports treated the pseudoaneurysm, continued the medication to control thrombosis for twelve to eighteen months and adequate follow up.³³ No complications reported in these reports, including the recurrence.¹⁷ Unfortunately, no information to date regarding long term morbidity and mortality on those treated using endovascular techniques.

Summary

In the management of posttraumatic pseudoaneurysm, the endovascular surgery, referred to as the alternative method for those who are not suitable for open surgery or conservative technique, showed good results.

Disclosure

The authors report no conflicts of interest in this work.

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