# Endovascular repair of ruptured external iliac artery pseudoaneurysm and arteriovenous fistula using reversed bell-bottom technique

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## ABSTRACT

Pseudoaneurysm and arteriovenous fistula can occur after iatrogenic trauma or penetrating injuries. Endovascular treatment is a minimally invasive method used to manage these complex vascular injuries. We have described the case of a 27-year-old male patient who had presented with progressively increasing pain and swelling of the left inguinal region after a gunshot injury 5 years earlier. The bell-bottom technique was used in a reversed fashion to exclude the pseudoaneurysm and treat the arteriovenous fistula, achieving symptom resolution without complications. (J Vasc Surg Cases Innov Tech 2023;9:1-4.)

**Keywords:** Arteriovenous fistula; Bell-bottom technique; False aneurysm; Pseudoaneurysm; Stent graft

Post-traumatic arteriovenous fistulas (AVFs) and pseudoaneurysms can occur after penetrating vascular injuries, iatrogenic or blunt trauma.[1-3] Progression can occur with enlargement of the pseudoaneurysm, compression of structures, rupture, neuropathy, thrombosis, and embolization.[1,3] Long-standing AVFs can be asymptomatic or lead to high-output heart failure, venous hypertension, arterial and venous dilation, and asymmetric limbs.[4] A coexistent pseudoaneurysm and AVF should be repaired immediately because delayed treatment has been associated with venous hypertension and an increased risk of hemorrhage. Endovascular management of pseudoaneurysms and AVFs is an effective and reliable alternative treatment.[3,4]

In the present report, we have described the case of a patient with a ruptured traumatic left external iliac artery (EIA) pseudoaneurysm and iliac AVF treated with an endoprosthesis using the reversed bell-bottom technique (BBT). The patient provided written informed consent for the report of his case details and imaging studies.

## CASE REPORT

A 27-year-old man, who was positive for human immunodeficiency virus and was not receiving HAART (highly active antiretroviral therapy), was referred for bulging in his left inguinal region. He described a progressive increase of 5 years' duration, associated with pain and intermittent fevers. The patient had a history of multiple exploratory laparotomies to treat a gunshot wound 5 years previously. The patient was tachycardic with normal blood pressure. A bulging pulsatile erythematous lesion with thrill and purulent drainage was present in his left lower quadrant and inguinal region. The laboratory test results showed a white blood cell count >40,000/μL with a left shift. Electrocardiography revealed left ventricle overload. Left lower extremity arterial duplex ultrasound and computed tomography angiography (CTA) of the abdomen revealed a ruptured pseudoaneurysm of the left EIA, an AVF between the common iliac vessels with surrounding fat stranding, and acute deep vein thrombosis on the left common femoral vein (Figs 1 and 2).

We decided to proceed with urgent percutaneous pseudoaneurysm repair using the reversed BBT. The reversed BBT was performed via access through the right common femoral artery (CFA) and the left superficial femoral artery (SFA) with 5F sheaths and the left axillary artery (AA) with the passage of a 12F sheath. Through the access in the right CFA, we performed catheterization and embolization of the left internal iliac artery with fiber coils (Figs 3 and 4). The prosthesis was introduced through the 12F sheath in the left AA, delivered in an antegrade fashion, and secured with ballooning of the prosthesis' extremities. The wider extremity of the prosthesis was located proximally at the left common iliac artery (CIA) and extending to the left EIA (Fig 5). Endovascular therapy was finalized with open primary closure of the left AA and open drainage of the pseudoaneurysm. The surgical wound was left open for secondary healing,

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**Fig 1.** Photographs showing bulging ulcerated erythematous lesion in the left inguinal region and left lower quadrant. On palpation, pulsatility and thrill were present.

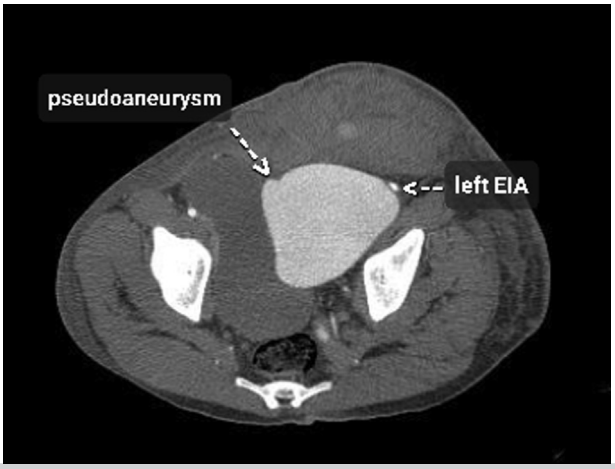


**Fig 2.** Computed tomography angiogram showing a large pseudoaneurysm in the left external iliac artery (EIA) that was compressing and causing deviation of the pelvic structures. Hematoma and densification of adjacent subcutaneous cellular tissue are also present.

and empiric intravenous antibiotics (piperacillin-tazobactam/clindamycin) were maintained for 14 days, followed by oral long-term antibiotics. The patient remained in the hospital for 28 days and received anticoagulation therapy with unfractionated heparin. Rivaroxaban was prescribed at discharge for 5 months because of the deep vein thrombosis. During the follow-up period, an echocardiogram was performed to evaluate the presence of cardiac failure and demonstrated a slight increase in the cardiac chambers with a preserved ejection fraction. The patient was referred to a cardiologist for

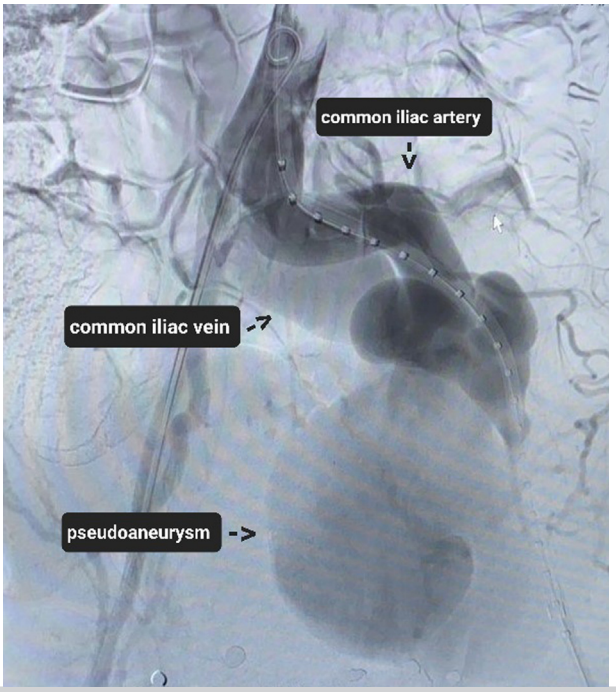


**Fig 3.** Angiographic image demonstrating dilation of the common iliac artery (CIA), a large pseudoaneurysm, and early contrast enhancement of the iliac vein characterizing an arteriovenous fistula (AVF).

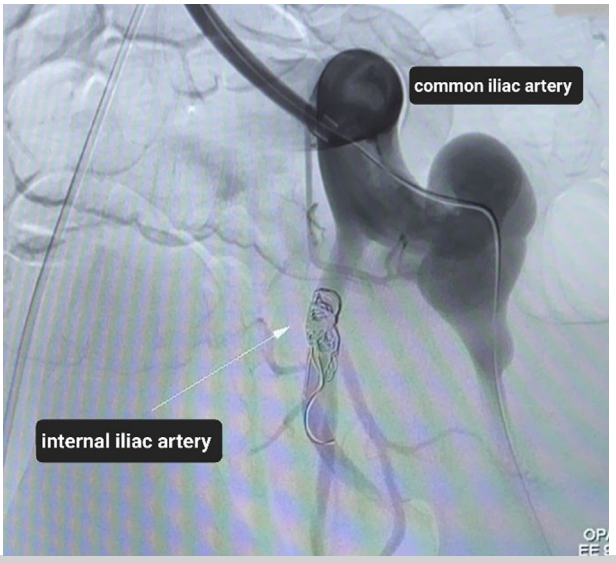


**Fig 4.** Angiographic image demonstrating embolization with fiber coils in the internal iliac artery.

follow-up. At the 6-month review, the symptoms had subsided without evidence of thrombosis or prosthesis complications found on the surveillance CTA. The surgical wound had healed.

## DISCUSSION

Traumatic vascular injuries are the leading cause of AVFs and pseudoaneurysms.[3] The most common

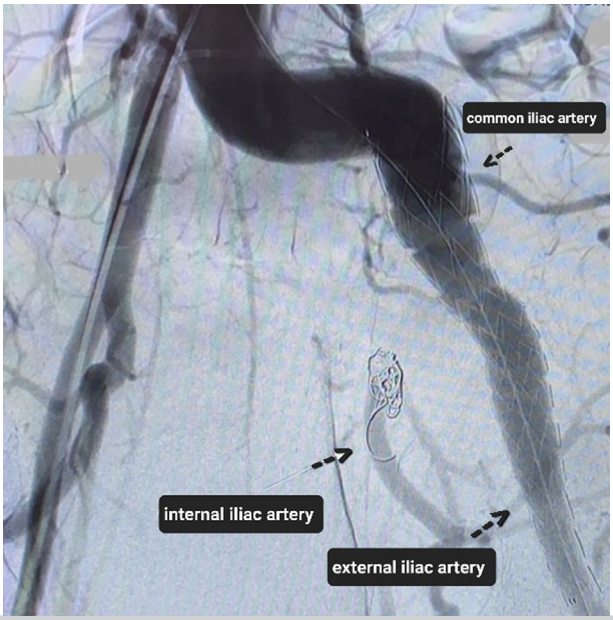


**Fig 5.** Digital subtraction angiogram showing the final aspect of the endoprosthesis with an effective seal, no evidence of endoleak, complete exclusion of the pseudoaneurysm, and interruption of the arteriovenous fistula (AVF).

anatomic site of traumatic AVFs are the arteries of the neck (the most common individual vessels involved in AVFs are the carotid artery and jugular vein) and thoracic outlet (54%). AVFs in the upper (22%) and lower limbs (20%) are less common. AVFs of the vessels of the abdomen and thorax constitute only 4%.[5] Aortocaval fistulas and AVFs involving the iliac, renal, superior mesenteric, splenic, and hepatic arteries have also been reported.[5] An early diagnosis is imperative to avoid complications and achieve a favorable outcome. Clinically, AVFs can present with a pathognomonic machinery murmur and thrill over the site of injury. However, these findings can also be absent, and imaging studies will be necessary for the diagnosis. Less invasive imaging modalities such as ultrasound, magnetic resonance imaging, and CTA can provide valuable information and often are the primary imaging examinations. Digital subtraction arteriography remains the reference standard for the diagnosis of AVF.[1,3,6]

These pathologies can be treated using an open or endovascular approach, and treatment must be performed emergently to reduce the incidence of complications.[1,2,5,6] Open surgical repair can be challenging because of the urgency, anatomic distortion around the lesion, the presence of hemorrhage, adjacent neurovascular structures, and the degree of contamination. Thus, the endovascular approach has become a feasible and effective procedure.[2,7]

Endovascular treatment included the use of covered stents and embolization.[6] However, the use of stent grafts requires the availability of appropriate fixation zones to obtain an effective seal.[4] The BBT is one of the primary endovascular techniques used in the treatment of abdominal aorta aneurysms with an ectatic CIA because a stent graft with a large iliac limb will promote an effective distal seal. This technique can be used with arteries with a diameter ≤25 mm.[8,9] We decided to treat our patient with an endovascular approach because of the delayed diagnosis with the increased risk of disastrous bleeding and the hostile abdominal anatomy owing to the multiple previous surgeries. The reversed BBT was chosen because of the discrepancy of the proximal and distal diameters of the iliac artery (18.5 mm and 6.9 mm, respectively), and the stent grafts used to treat extremities have a uniform diameter. The procedure was performed with the patient under general anesthesia, with endovascular access via the right CFA and left SFA with a 5F sheath and dissection of the left AA with passage of a 12F sheath. Embolization of the left internal iliac artery was performed through the right CFA and crossing over the iliac bifurcation, followed by catheterization of the vessel, with the delivery of four detachable concerto helix fiber coils (10 mm × 30 cm; Medtronic, Miami, FL). An InCraft endoprosthesis (Cordis Corp, Hialeah, FL) with a proximal and distal diameter of 10 mm and 20 mm, respectively, and a length of 140 mm was used, with exploitation of the bell portion in the left CIA and antegrade deployment in a reverse technique to accommodate the endoprosthesis in the dilated left CIA and EIA to achieve exclusion of the pseudoaneurysm and closure of the iliac AVF. The rationale for using the AA to introduce the graft was the unavailability of the left SFA owing to tissue edema and infection, a tight iliac bifurcation, severe tortuosity, and dilation of iliac vessels, which prevented crossover from the right CFA. Because of the infection and ruptured pseudoaneurysm, open drainage was used for better infection control and decompression of the pelvic structures. Reflux bleeding from the iliac vein could have occurred at this point, and placement of a vein stent graft could be an option to manage such a serious complication. Additionally, because of the high risk of further infection of the endoprosthesis, preemptive oral antibiotics (amoxicillin-clavulanate) were maintained until 6 months postoperatively. The choice of the long-term antibiotic was determined by the most common infectious microorganisms found, in particular, *Staphylococcus* spp, once the cultures were negative. The appropriate duration of antibiotics for these patients has not been defined and, therefore, will largely be determined by patient presentation, degree of purulence noted intraoperatively, choice of conduit (autogenous vs prosthetic), patient risk factors for reinfection, and virulence of the cultured organisms.[10] In addition, lifelong surveillance is prudent.

## CONCLUSIONS

Simultaneous presentation of a pseudoaneurysm and an AVF is a rare entity and can require complex treatment depending on the diagnosis delay and urgency. Endovascular treatment with a reversed BBT is a reliable and effective alternative for treating these patients.

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