



False aneurysm of perforating branch of the deep femoral artery—Report of two cases



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ABSTRACT

Pseudoaneurysms of the deep femoral artery are uncommon and occur as a late complication of various traumas. Usually associated with femoral fractures, We report two cases of profunda femoris artery injury which presented as false aneurysm secondary to penetrating trauma. Because of its insidious onset, awareness and careful follow-up are the key issues for the early diagnosis.

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1. Introduction

Pseudoaneurysms (PSAs) of deep femoral artery (DFA) are rare injuries and have been reported following penetrating and blunt trauma to the thigh and orthopedic procedures of the proximal femur [1–2]. Symptomatic injury is usually manifested by haemorrhage. However, it is likely that many injuries are sub-clinical and remain undetected [3]. Local effects of pseudoaneurysm are secondary to mass effect on adjacent structures causing compromise of function [4]. This condition may promote formation of pulsating mechanism injury in the area and erosion of the neighboring vein's wall [5–6]. We report two cases of profunda femoris artery injury which presented as false aneurysms and describe two alternative methods of management.

2. Cases report

2.1. Case 1

A 23-year-old man sustained a stab wound in the middle of the posterior right thigh, which was treated by primary suturing. Two months later, he was admitted with increasing pain and swelling in the right thigh. Physical examination revealed a 4 × 6 cm pulsatile mass with a palpable thrill in this area. On auscultation, a loud systolic bruit was heard over the mass. All distal pulses were present and equal bilaterally. Color doppler showed turbulent flow within the saccular structure with a wide necked communication with DFA, findings consistent with the diagnosis of pseudoaneurysm. A

64-slice multidetector CT angiography confirmed the presence of a large pseudoaneurysm arising from the second perforating branch of the DFA, and there was also a communication of approximately 2 cm visualized between the cystic lesion and the deep femoral vein (DFV) with arterialization of the normal venous flow within the vein (Fig. 1). Open surgical repair was considered appropriate, the patient underwent repair through anteromedial approach under general anesthesia. A vertical incision was made parallel to the lateral border of the sartorius muscle at the lower end of the femoral triangle. Control of the deep femoral artery was obtained between the sartorius and the rectus femoris muscles. Axial dissection of the PFA was carried out, exposing it alongside the deep femoral vein. A 4 × 6 cm PSA was extirpated with ligation of the second perforating branch of the DFA, and the venous breach was repaired with 5/0 polypropylene suture. The postoperative course was uncomplicated and the patient was discharged on the fifth postoperative day.

2.2. Case 2

A 28-year-old male sustained a stab wound in the middle of the posterior right thigh. He had no signs of vascular injury immediately after the trauma and he was discharged after wound dressing and antibiotic prophylaxis. 20 days later, he was admitted to our department with bleeding from the sutured wound. At the same time, there was associated tachycardia with a fall in the hemoglobin levels from 12 to 8 g/dl. After removing stitches, a 3 cm wound with active bleeding was observed in this area. Distal pulses were detected manually. Selective arteriography of the profunda femoris artery via the contralateral approach showed a 3 cm pseudoaneurysm of the second perforating branch of the deep femoral artery (Fig. 2A). This was successfully and electively embolised by

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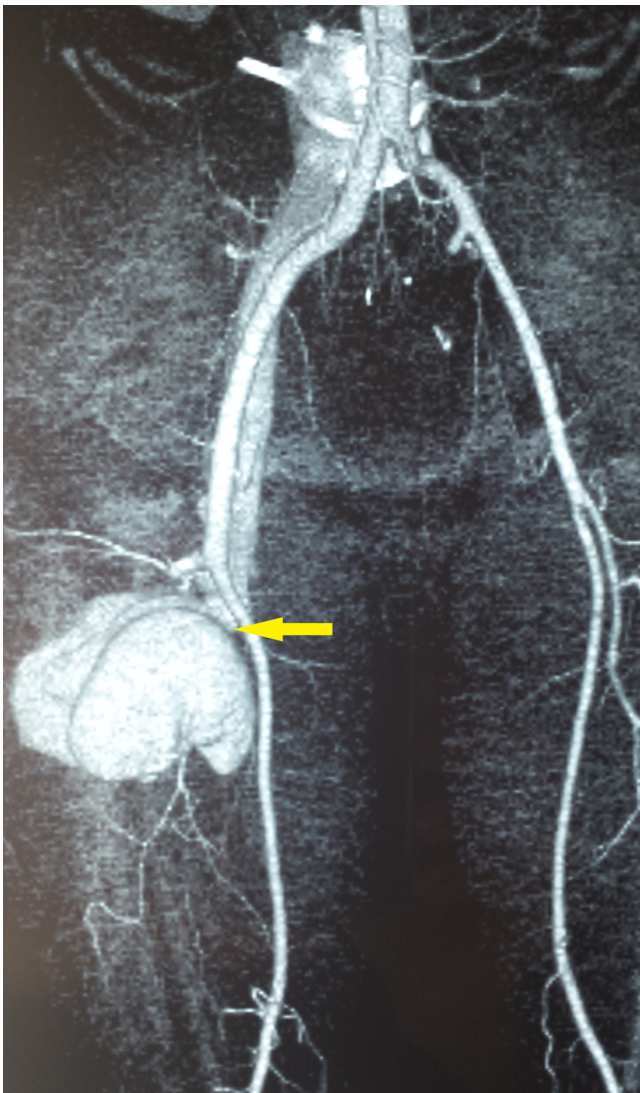


Fig. 1. Computed tomography angiogram of the lower limbs showing a pseudoaneurysm of the second perforating branch of the DFA with femoro-femoral arteriovenous fistula (arrow).

Cook® coils and the bleeding arrested (Fig. 2B). 3 days later, he presented again further bleeding episodes. The patient was operated upon through a vertical femoral incision. Control of the common, superficial, and profunda femoris arteries was obtained. On evacuating a hematoma, a laceration of the perforator branch was found. The injured branches was ligated. The patient did well postoperatively and was discharged on the 10th day. He was asymptomatic during 6 months of follow-up.

3. Discussion

The profunda femoris artery lies deep in the thigh and is protected against external trauma by the vastus medialis muscle and is most vulnerable to injury in the sub-trochanteric area [3].

Injury to the DFA accounts for approximately 2% of peripheral arterial wounds [7–8]. Complications of undiagnosed and inaccessible arterial injuries include pseudoaneurysm, arteriovenous fistula, and vessel occlusion [9]. Causes include iatrogenic (percutaneous or open arterial catheterizations, leakage occurring at anastomoses between grafts and vessels, or orthopedic manipulations), traumatic (blunt, penetrating, and gunshot injuries), and other factors such as infection, hip torsion during sporting activity, intra-venous

drug usage, and true aneurysms. In our cases, the etiology was stabbing [9–10].

PSAs associated with arteriovenous fistula are uncommon following penetrating wound trauma of the limbs and have rarely been reported [11]. Iatrogenic causes may be promoted by some vascular anomalies, Stefanczyk et al. have described a case of postnephrectomy arteriovenous fistula in a patient with tuberous sclerosis and anomalous inferior vena cava which was successfully treated by endovascular amplatzer occluder implantation [12]. Moreover, cardiac or valvular defects in Down syndrome may predispose, through endocarditis, to vascular involvement such distal embolization and pseudoaneurysm formation [13–14].

Pseudoaneurysms arise from a disruption in arterial wall continuity resulting from inflammation, trauma, or iatrogenic causes such as surgical procedures [15]. Under the influence of sustained arterial pressure, blood dissects into the tissues around the damaged artery and forms a perfused sac that communicates with arterial lumen [15–16]. The perfused sac is contained by the media or adventitia or simply by soft-tissue structures surrounding the injured vessel [4].

DFA injuries may be overlooked due to delayed presentation and also because distal pulses are usually present. Accurate diagnosis is difficult as this artery is located deep in the thigh [17]. Pseudoaneurysms typically present late and signs such as persistent hip pain, thigh swelling, and the presence of a pulsatile mass and unexplained anaemia may suggest the diagnosis [3].

Without a clear history of trauma, the lesion may mimic some soft tissue conditions like abscesses or neoplasms [18]. The time from injury to PSA presentation is variable although in the commonest situation, minimal arterial wall damage allows only a slow progression in size with a subsequent later presentation many months after injury [19]. Unless hemodynamic instability and high clinical suspicion of active bleeding prompts a diagnosis of the rupture of the artery and pseudoaneurysm [20]. Careful examination and auscultation should be performed over an injured area.

Post-traumatic AVF is an unusual disease with a wide variability of presentations. Careful examination reveals a pathognomonic machinery murmur and thrill over the site of injury. However, diagnosis of this entity may be overlooked if these physical findings are not present [21]. In a retrospective review, Mellièrè et al. observed that the clinical course appeared to be related to the relative flow state of the AVF. They noted that low-flow AVF was usually uncomplicated and might occasionally close spontaneously, while high-flow AVF were associated with early cardiac complications that usually necessitated surgical correction before the onset of arterial dilatation. However, medium-flow AVF were associated with proximal arterial dilatation generally discovered later with or without concomitant cardiac complication [22]. Our first patient would appear to represent this latter group, he had leg edema without any cardiac signs. Significant lower extremity AVF that is not treated or do not resolves spontaneously may present months to years later with venous hypertension marked by limb edema, stasis dermatitis, and venous ulceration [23–24]. Claudication and symptoms of congestive heart failure may also ensue.

A high clinical index of suspicion and radiological imaging [particularly computed tomography (CT), angiography, and duplex ultrasonography] plays a major role in obtaining a diagnosis [18]. Multidetector CT angiography enables 3-dimensional reformatting of the lower limb vasculature. It is a quick and non-invasive method, with high sensitivity (90–95%) and specificity (98–100%) for detecting arterial injury after trauma [25].

Experience in treatment of PFA pseudoaneurysms is limited. Symptomatic PSAs (intermittent or continuous bleeding) should be treated. However, the decision to treat asymptomatic pseudoaneurysms is controversial. The majority of small PSAs (less than 2–3 cm in diameter) is prone to thrombose spontaneously within

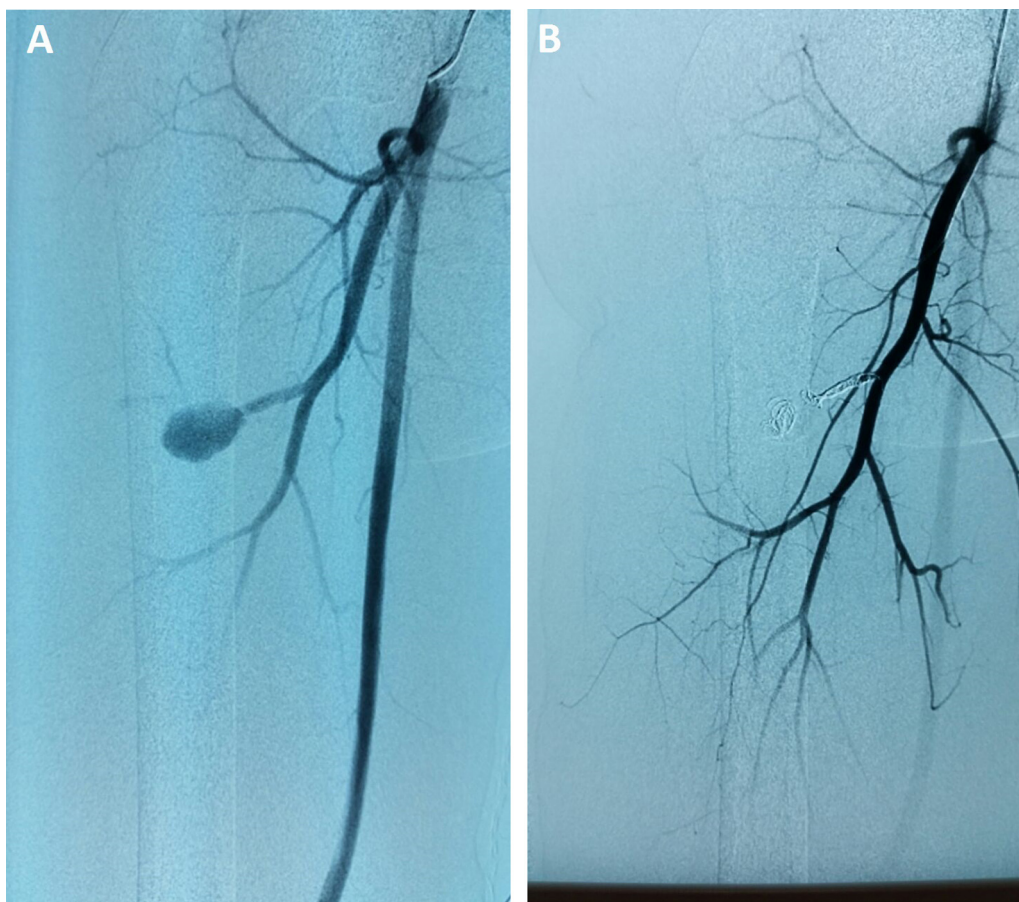


Fig. 2. Elective right deep femoral artery angiography pictures showing the pseudoaneurysm. (A) Before coil embolization ; (B) after coil embolization.

4 weeks [26–27]. We recommend observing small, asymptomatic PSAs and treating them only if they enlarge, do not resolve, or become symptomatic [4]. False aneurysm can obliterate spontaneously, especially when smaller than one inch and with a small neck (<10 mm) [28].

Current therapeutic approaches include open surgical repair, ultrasound-guided compression, ultrasound-guided thrombin injection and endovascular repair using coil embolization or stent-graft insertion. In the presence of compressive neuropathy, limb ischaemia, distal embolisation, skin necrosis, infection, or the risk of rupture, surgery has been recommended as the treatment of choice [29], the incidence of post-operative complications may be as high as 20% with up to a 3% mortality rate [30]. The anteromedial approach to whole trunk of the DFA as first described by Suter is now the standard one for most procedures of DFA reconstruction. The DFA can be readily exposed from its origin at bifurcation of the common femoral artery down to its distal branches [31]. In our first case, surgery was judged the more appropriate treatment as the PSA was considerably larger and associated with a AVF. Over the past few years, endovascular repair of PFA haemorrhage or pseudoaneurysms with covered stents has become feasible [32–33]. However, selective embolization is increasingly considered as the most effective treatment for PSA of DFA [34]. It is used by either ultrasound-guided direct puncture in the sac, or by catheter placement to occlude the neck [35]. In spite of its lower complication rate, recanalization of the embolized vessel and reconstitution of arterial flow to the pseudoaneurysm (delayed failure of embolization) have been reported; however, this phenomenon is very rare [36]. For this reason, operative treatment was undertaken in Case 2 where the PSA bled again after a primary embolization.

The profunda femoris artery has a collateral supply, therefore, one must embolize both proximal and distal to the pseudoaneurysm to completely exclude it from the circulation by preventing backflow from the collateral circulation [37]. Cook coils, which were used for selective embolisation. In our second case, they were made of platinum. This coils are softer, then a disadvantage of using platinum coils is the potential for recanalization of the embolized sac if the coils are not tightly packed [4]. We think that the failure of the embolization procedure in Case 2 was due to the backflow from the collateral circulation, because the distal exclusion of the PSA has not been done. However, the nature of coils and deployment's technique were less offending in failure.

Post-traumatic fistulas should be surgically repaired as soon as possible [38]. In the early stages, surgery is easier because there is no scar tissue or collateral circulation to complicate the dissection, and the anatomy is not distorted [39]. Although surgical closure of AVFs remains the gold standard, other treatment options include covered stent and coil embolization. These stents provide a less invasive choice for repairing the fistula, especially in hemodynamically unstable patients [40–41].

4. Conclusion

As these cases illustrate, the diagnosis of pseudoaneurysm of deep femoral artery following trauma an orthopedic procedures requires awareness and a high index of suspicion. When they are overlooked, pseudoaneurysms can develop as late complications. Angiography should be performed in cases with a high index of suspicion. A simple surgical approach is effective in preventing such complications.

Conflict of interests

None.

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None.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author's contributions

Hamza Naouli: first author, writing, study design, data collections.

Hamid Jiber: 3rd author, writing, data collections.

Abdellatif Bouarhroum: Study design, corrections.

References

- [1] K.C. Chong, E.C. Yap, K.S. Lam, B.Y. Low, Profunda femoris artery pseudoaneurysm presenting with triad of thigh swelling, bleeding and anaemia, *Ann. Acad. Med. Singap.* 33 (2) (2004) 267–269.
- [2] S. Canbaz, M. Acipayam, H. Gurbuz, E. Duran, False aneurysm of perforating branch of the profunda femoris artery after external fixation for a complicated femur fracture, *J. Cardiovasc. Surg.* 43 (4) (2002) 519–522.
- [3] G.B. Hanna, R.J. Holdsworth, P.T. McCollum, Profunda femoris artery pseudoaneurysm following orthopaedic procedures, *Injury* 25 (1994) 477–479, September.
- [4] N.E. Saad, W.E. Saad, M.G. Davies, D.L. Waldman, P.J. Fultz, D.J. Rubens, Pseudoaneurysms and the role of the minimally invasive techniques in their management, *Radiographics* 25 (2005) S173–S189.
- [5] Z. Bozgeyik, H. Ozdemir, I. Orhan, M. Cihangiroglu, Z. Cetinkaya, Pseudoaneurysm and renal arteriovenous fistula after nephrectomy: two cases treated by transcatheter coil embolization, *Emerg. Radiol.* 15 (2008) 119e22.
- [6] M. Taneja, N. Lath, T.B. Soo, T.K. Hiong, M.M. Htoo, L. Richard, A.C. Fui, Renal artery stump to inferior vena cava fistula: unusual clinical presentation and transcatheter embolization with the Amplatzer vascular plug, *Cardiovasc. Interv. Radiol.* 31 (Suppl. 2) (2008) S92e5.
- [7] W.H. Synder III, E.R. Thal, M.O. Perry, Vascular injuries of the extremity, in: R.B. Rutherford (Ed.), *Vascular Surgery*, 3rd ed., Saunders, Philadelphia, 1989, pp. 613–637.
- [8] J.M. Loubeau, H.T. Bahnson, Traumatic false aneurysm and arteriovenous fistula of the profunda femoris artery: surgical management and review of the literature, *Surgery* 81 (1977) 222–227.
- [9] A.T. Yilmaz, M. Arslan, U. Demirkilic, E. Ozal, E. Kuralay, H. Tatar, et al., Missed arterial injuries in military patients, *Am. J. Surg.* 173 (1997) 110–114.
- [10] P. Currie, C.M. Turnbull, T.R. Shaw, Pseudoaneurysm of the femoral artery after catheterization: diagnostic and treatment by manual compression guided by doppler color-flow imaging, *Br. Heart J.* 72 (1994) 80–84.
- [11] H.E. Daniel, A. Firmin, P.O. Angele, M.N. Esthelle, B. Freddy, N.N. Bernadette, Giant pseudoaneurysm associated with arteriovenous fistula of the brachial and femoral arteries following gunshot wounds: report of two cases, *Case Rep. Vasc. Med.* 2015 (2015) 454713.
- [12] L. Stefanczyk, W. Religa, J. Kasprzak, K. Szymczyk, M. Polguj, Giant postnephrectomy arteriovenous fistula in a patient with tuberous sclerosis and anomalous inferior vena cava: treatment with Amplatzer Vascular Plug embolization, *Ann. Vasc. Surg.* 28 (5) (2014), 1318. e7–10.
- [13] J.J. Bosch, Health maintenance throughout the life span for individuals with down syndrome, *J. Am. Acad. Nurse Pract.* 15 (2003) 5–17.
- [14] D.K. Nakayama, J.A. O'Neill, H. Wagner, A. Cooper, R.H. Dean, Management of vascular complications of bacterial endocarditis, *J. Pediatr. Surg.* 1 (1986) 467–470.
- [15] L.B. Schwartz, E.T. Clark, B.L. Gewertz, Anastomatic and other pseudoaneurysms, in: R.B. Rutherford (Ed.), *Vascular Surgery*, 5th ed., Saunders, Philadelphia, Pa, 2000, pp. 752–763.
- [16] A.E. Zimon, J.K. Hwang, D.L. Principe, R.O. Bahadosingh, Pseudoaneurysm of the uterine artery, *Obstet. Gynecol.* 94 (5 pt 2) (1999) 827–830.
- [17] J. Khoshnevis, M.R. Sobhiyeh, M.F. Zavareh, Deep femoral artery branch pseudoaneurysm after orthopedic procedure requiring surgical treatment: a case report, *Trauma Mon.* 17 (2) (2012) 305–308.
- [18] F. Valli, M.G.A. Teli, M. Innocenti, R. Vercelli, D. Prestamburgo, Profunda femoris artery pseudoaneurysm following revision for femoral shaft fracture nonunion, *World J. Orthop.* 4 (July 18 (3)) (2013) 154–156.
- [19] J. Chandrasenan, J.P. Garner, P.D. Meiring, K. Kumar, Coil embolisation for an iatrogenic profunda femoris pseudoaneurysm, *Inj. Extra* 37 (2006) 249–252.
- [20] J.J. Entwisle, M. De Nunzio, D. Hinwood, Transcatheter embolization of pseudoaneurysm of the profunda femoris artery complicating fracture of the femoral neck, *Clin. Radiol.* 56 (2001) 424–427.
- [21] K. Nagpal, K. Ahmed, R.J. Cuschieri, Diagnosis and management of acute traumatic arteriovenous fistula, *Int. J. Angiol.* 17 (4) (2008) 214–216.
- [22] D. Melliere, R. Hassen-Khodja, J.M. Cormier, P. Le Bas, A. Mikati, H. Ronsse, Proximal arterial dilatation developing after surgical closure of long-standing posttraumatic arteriovenous fistula, *Ann. Vasc. Surg.* 11 (1997) 391–396.
- [23] J.G. Brawley, J.G. Modrall, Traumatic arteriovenous fistulas, in: R. Rutherford (Ed.), *Vascular Surgery*, 6th ed., Elsevier Saunders, Philadelphia, 2005, pp. 1619–1625.
- [24] C.F. Weng, J. Wei, Y.T. Lee, S.H. Sue, Y.C. Chuang, C.Y. Chang, et al., High-output heart failure resulting from an obscure traumatic arteriovenous fistula, *J. Chin. Med. Assoc.* 71 (2008) 428–430.
- [25] M.M. Miller-Thomas, O.C. West, A.M. Cohen, Diagnosing traumatic arterial injury in the extremities with CT angiography: pearls and pitfalls, *Radiographics* 25 (Suppl. 1) (2005) S133–S142.
- [26] W.D. Middleton, A. Dasyam, S.A. Teefey, Diagnosis and treatment of iatrogenic femoral artery pseudoaneurysms, *Ultrasound Q.* 21 (2005) 3e17.
- [27] B. Toursarkissian, B.T. Allen, D. Petrinec, R.W. Thompson, B.G. Rubin, J.M. Reilly, et al., Spontaneous closure of selected iatrogenic pseudoaneurysms and arteriovenous fistulae, *J. Vasc. Surg.* 25 (1997) 803e8, discussion 808e9.
- [28] E.D. Ritchie, D. Haverkamp, T.J.M.J. Schiphorst, K. Bosscha, False aneurysm of the profunda femoris artery, a rare complication of a proximal femur fracture, *Acta Orthop. Belg.* 73 (2007) 530–532.
- [29] G.J. O'Sullivan, S.A. Ray, J.S. Lewis, et al., A review of alternative approaches in the management of iatrogenic femoral pseudoaneurysms, *Ann. R. Coll. Surg. Engl.* 81 (1999) 226–234.
- [30] M.M. Sedwitz, R.J. Hye, B.E. Stabile, The changing epidemiology of pseudoaneurysm: therapeutic implications, *Arch. Surg.* 123 (1988) 473–476.
- [31] M.Y. Suter, Surgical approaches, in: M.P. Merlini, R.J.A.M. Van Dongen, M. Dusmet (Eds.), *Surgery of the Deep Femoral Artery*, Springer-Verlag, Berlin, Heidelberg, 1994.
- [32] G.N. Kouvelos, N.K. Papis, E.M. Arnaoutoglou, G.S. Papadopoulos, M.I. Matsagkas, Endovascular repair of profunda femoral artery false aneurysms using covered stents, *Vascular* 19 (1) (2011) 51–54.
- [33] M.H. Eslami, B.A. Silvia, Endovascular repair of femoral artery pseudoaneurysm after orthopedic surgery with balloon-expandable covered stents, *Vasc. Endovasc. Surg.* 42 (2) (2008) 176–179.
- [34] S. Singh, S. Arora, A. Thora, R. Mohan, S. Sural, A. Dhal, Pseudoaneurysm of profunda femoris artery following dynamic hip screw fixation for intertrochanteric femoral fracture, *Chin. J. Traumatol.* 16 (4) (2013) 233–236.
- [35] H. Kobeiter, M. Lapeyre, J.-P. Becquemin, D. Mathieu, D. Melliere, P. Desgranges, Percutaneous coil embolization of post catheterisation arterial femoral pseudoaneurysm, *J. Vasc. Surg.* 36 (2002) 127–131.
- [36] R. Guillon, J.M. Gracier, A. Abergel, et al., Management of splenic artery aneurysms and false aneurysms with endovascular treatment in 12 patients, *Cardiovasc. Interv. Radiol.* 26 (3) (2003) 256–260.
- [37] M.A. Arata, C. Cope, Principles used in the management of visceral aneurysms, *Tech. Vasc. Interv. Radiol.* 3 (2000) 124–129.
- [38] T. Nara, D. Yoshikawa, S. Saito, Y. Kadoi, T. Morita, F. Goto, Perioperative management of biventricular failure after closure of a long-standing massive arteriovenous fistula, *Can. J. Anaesth.* 48 (2001) 588–591.
- [39] R.L. Treiman, J.L. Cohen, D.J. Gaspard, M.R. Gaspar, Early surgical repair of acute posttraumatic arteriovenous fistulas, *Arch. Surg.* 102 (1971) 559–561.
- [40] A.S. Kendrick, L.R. Sprouse, Repair of a combined femoral pseudoaneurysm and arteriovenous fistula using a covered stent graft, *Am. Surg.* 73 (2007) 227–229.
- [41] J. O'Brien, O. Buckley, W. Torreggiani, Hemolytic anemia caused by iatrogenic arteriovenous iliac fistula and successfully treated by endovascular stent-graft placement, *AJR Am. J. Roentgenol.* 188 (2007) 306.

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