



Case report

External iliac pseudoaneurysm secondary to medial wall penetration of an acetabular screw: a rare cause of total hip arthroplasty failure 15 years after implantation

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ABSTRACT

Vascular injury as a result of total hip arthroplasty (THA) represents an uncommon complication. Although these injuries typically present acutely, delayed presentation has been reported. In this case, a 70-year-old female presented with groin pain and medial thigh numbness 15 years after a left THA. After initially being misdiagnosed, repeat imaging revealed a large external iliac pseudoaneurysm as a result of a transacetabular screw penetrating the medial acetabular wall. The patient underwent staged endovascular exclusion of the pseudoaneurysm, percutaneous drainage, and revision THA. She had resolution of her symptoms. To our knowledge, this is the only reported case of a late vascular injury related to an aseptic THA with well-fixed components. Staged treatment with endovascular exclusion and revision THA is a viable approach.

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Introduction

Total hip arthroplasty (THA) is one of the most successful orthopedic procedures performed. The incidence of THA continues to rise [1–5], and in 2010, around 2.5 million Americans were living with a total hip prosthesis. Despite the reported long-term success of THA [6], failure with necessitated revision has been reported for a number of reasons [7]. Vascular injuries as a result of THA, however, are uncommon. The reported incidence has varied, but vascular injury has been noted to occur in 0.08%–0.3% of cases [8–11]. The focus in the literature, with regards to vascular injury during THA, has primarily been on intraoperative injury. Although most vascular injuries during total joint arthroplasty have been reported to occur due to trauma from retractor placement or

traction [12,13], in the series presented by Parvizi et al [11], direct laceration constituted the most common reason for injury during THA. These injuries are usually recognized intraoperatively [9,11] and occasionally present in the early postoperative period [11]. Although most attention has been paid to these acute injuries, there have been several reports of delayed presentation of hematomas and pseudoaneurysm (PSA) formation [14–16].

There have been many patient and operative risk factors identified for arterial injury during THA. One such risk factor is transacetabular screw placement [17]. It has long been recognized that placement of transacetabular screws must be done with caution and that attention must be paid to the acetabular quadrant in which these are placed [18–21]. Here, we report a case of symptomatic external iliac artery (EIA) PSA formation secondary to a transacetabular screw with medial wall penetration. This case is unique in that the patient first presented 15 years after her index procedure.

Case history

The patient is a 70-year-old female with a past medical history significant for hyperlipidemia, overactive bladder, chronic low back

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pain with occasional radicular pain, and bilateral THA and left total knee arthroplasty. Her left THA had been performed 15 years prior and she had done very well. She was initially seen by an orthopedist for left groin pain, with numbness and tingling to her left medial thigh for several weeks. Hip examination at that time revealed flexion to 100°, external rotation to 25°, internal rotation to 10°, and abduction to 25°. There was some pain with range of motion, but this was nonspecific and was felt to be radicular in nature, limiting evaluation for iliopsoas impingement. Therefore, she was prescribed oral steroids, cyclobenzaprine, and sent to physical therapy, all without relief. She subsequently presented to the emergency department (ED), where radiographs (anteroposterior [AP] pelvis, and AP/lateral of the left femur) did not reveal any signs of loosening or obvious hardware complication (Fig. 1). A magnetic resonance imaging of the lumbar spine demonstrated multilevel degenerative changes with areas of severe canal stenosis, most notably at L3–4 (Fig. 2). This examination also noted inflammatory changes in the left iliacus muscle which “may represent myositis.” Examination at this visit was unremarkable and the patient had normal, palpable distal pulses. No further workup was obtained on this visit, and the patient was discharged with diagnosis of myositis and radicular lumbar pain.

The patient returned to the ED 4 days later with similar complaints as she was not improving. At that time, a noncontrast computed tomography (CT) of the abdomen and pelvis was interpreted as inflammation of the iliacus, thought to be caused by a prominent acetabular screw (Figs. 3, 4a, and b). Inflammatory markers were also obtained and her C-reactive protein was 23.3 (normal <10.0) and erythrocyte sedimentation rate was 26 (normal <30). Her elevated C-reactive protein and CT findings were attributed to myositis. The patient was again discharged and sent for outpatient follow-up a week later. The patient's pain was then attributed to spinal disease and L4 radiculopathy given her complaints of medial thigh radicular pain and numbness. She later underwent L3–4 and L4–5 transforaminal epidural steroid injections which were unsuccessful in relieving her pain.

Nearly 2 months later the patient returned to the ED where she was given narcotics and a pain management physician performed an injection of her hip. These interventions provided minimal relief. Her vascular examination during these visits remained normal. Two weeks later, the patient began to develop asymmetric left leg swelling. Venous duplex revealed a left common femoral vein deep vein thrombosis (DVT) and a PSA in the left groin. She was started on anticoagulation and referred to vascular surgery. The patient returned to the ED 3 days later for worsening swelling, numbness, and pain. At this visit, a CT-angiogram was obtained which was notable for a large, 13 cm × 7 cm PSA of the left EIA which had grown substantially (Fig. 4c



Figure 2. T2-weighted midsagittal cut of the lumbar spine demonstrating multilevel degenerative changes and canal stenosis, which is severe at L3–4.

and d). The medially penetrated left acetabular screw was noted to extend into this lesion by over 2 cm (Fig. 4a and c, arrows). Significant mass effect on the surrounding vessels was noted with displacement and near-occlusion of the left EIA and compression of the femoral vein.

Examination was notable for 1+ pitting edema to the entire left lower extremity and decreased sensation to light touch along the entire medial aspect of the leg. A painful, palpable mass within the left groin was noted. Both femoral and pedal pulses remained palpable at this time, and triphasic Doppler signals were present. Vascular surgery performed an angiogram revealing active extravasation into a large PSA and this was treated with two 9 mm × 5 cm covered stent grafts to exclude the PSA (Fig. 5). Then, immediate ultrasound-guided aspiration of her large surrounding hematoma extracted 240 cc of blood and the patient noted immediate improvement in her pain.

The patient was then referred to orthopedics for removal of hardware. Approximately 1 month after her endovascular procedure, the patient was electively taken to the operating room, where she underwent a femoral head ball and acetabular liner exchange

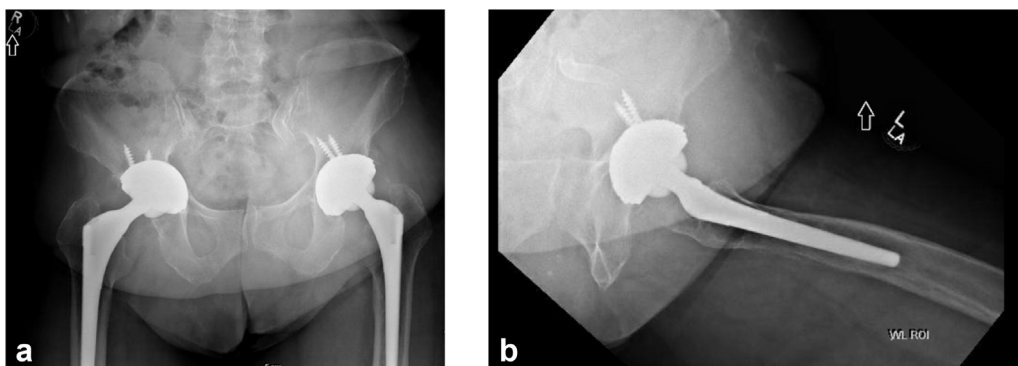


Figure 1. (a) Anterior-posterior pelvis radiograph demonstrating bilateral total hip arthroplasty with no hardware complications. Of note, on this single view, there is no obviously malpositioned hardware in the left hip or soft tissue masses. (b) Frog-leg lateral view of the left hip, again with no hardware complications or soft tissue masses.

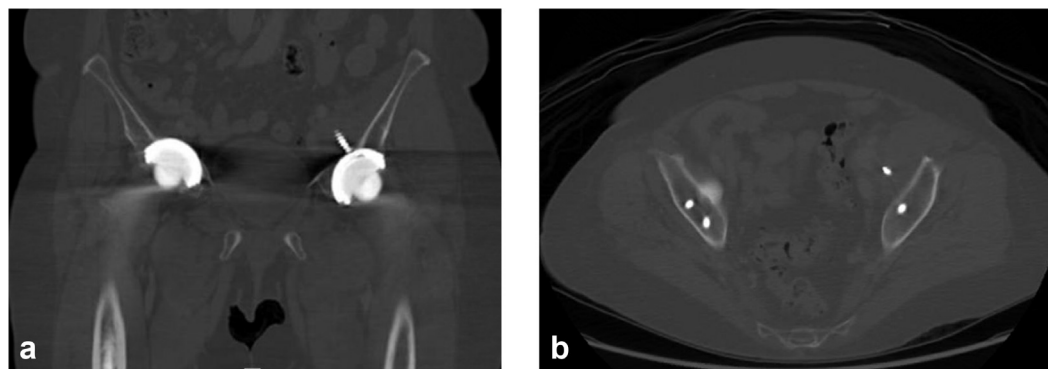


Figure 3. (a) Coronal cut of noncontrast CT of the pelvis demonstrating significant medial wall perforation (>2 cm) of a left-sided acetabular screw. (b) Axial cut from the same examination demonstrating the extent of medial screw penetration, and its termination in the asymmetric fullness within the left iliacus muscle.

with removal of her 2 acetabular screws through a standard posterior approach. The implicated screw was found in the anterior-superior quadrant of the acetabulum [20]. After removal of the screws, there was no bleeding through the screw hole or changes in her hemodynamics. Her components were noted to be stable and were retained (Fig. 6). She tolerated the procedure without issue and was discharged on postoperative day 1. On most recent follow-up the patient is doing well and reports resolution of her symptoms.

Discussion

Vascular injury following THA is a rare, but potentially catastrophic complication. In their 1990 review, Shoenfeld et al [22] found that vascular injury associated with THA carried a 7%

incidence of mortality and 15% incidence of amputation. Interestingly, the same review found that 60% of these complications occurred during primary arthroplasty and that the EIA was the most commonly injured [22]. The majority of literature surrounding vascular injury in THA has focused on acute presentation with fewer cases of delayed presentation being reported—and one delayed presentation described as iliacus hematoma (without a named iliac artery injury) [16].

PSAs following THA have been reported in the EIA, common femoral artery, profunda femoris artery, superficial femoral artery, and the medial circumflex femoral artery [23]. Although PSA formation can manifest acutely [24], they are unlike cases of arterial laceration or thrombosis which are typically more clinically obvious with bleeding and/or ischemia [25]. PSAs present in a more delayed

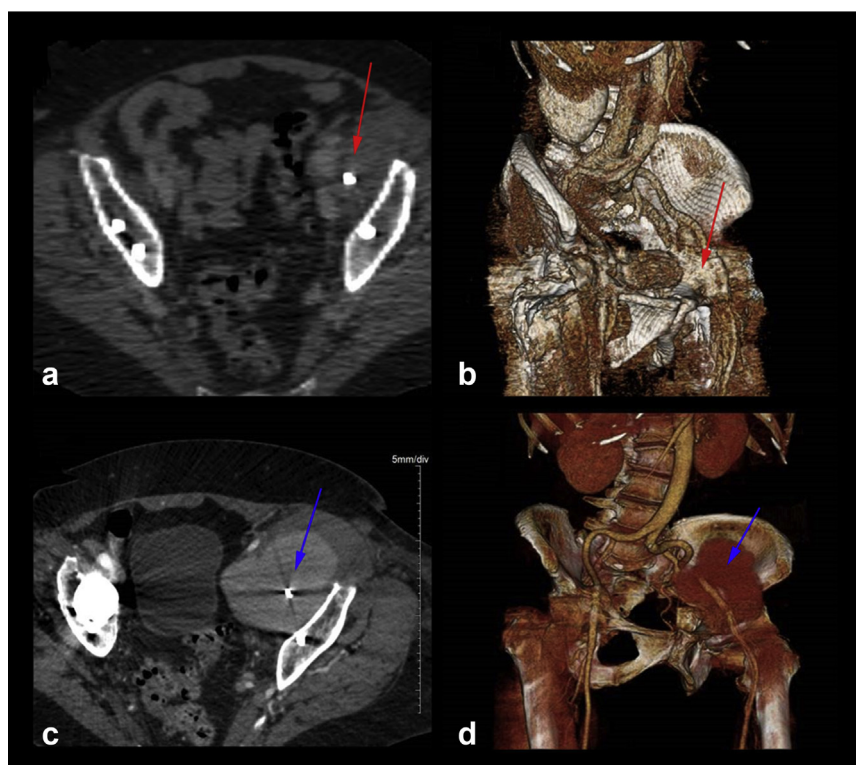


Figure 4. (a) Axial cut of noncontrast CT demonstrating initial left external iliac PSA that was underappreciated. Red arrow shows the location of the screw in the small PSA. (b) Three-dimensional reconstruction of the same noncontrast CT scan demonstrating mass effect in the area of PSA confused with myositis. (c) Axial image of CT angiogram done 2 months later showing large PSA with screw in the center (blue arrow). (d) Three-dimensional reconstruction of the CT angiogram demonstrating the large PSA and its mass effect on the EIA compared to image B.

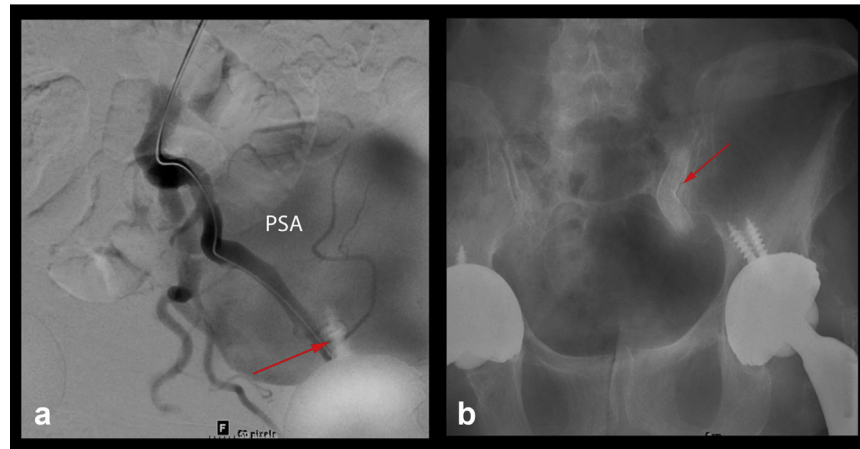


Figure 5. (a) Large PSA seen as a large, circular contrast extravasation surrounding the artery. Arrow shows the acetabular screw. (b) Demonstration of the covered stent grafts (arrow) after relining the injured external iliac vessels at risk, which is what occurred in this case.

fashion with typically vague complaints of pain or surrounding nerve compression. Mallory et al [14] reported a case of common femoral PSA secondary to sharp Homan retractor penetration that presented as progressive groin pain with a palpable mass 3 months postoperatively. Similarly, Bechet et al [15] reported a PSA of the common femoral artery 7 months after THA secondary to a cement fragment in contact with the artery. Proschek et al [23] also reported on a patient who developed common femoral PSA as a result of a malpositioned acetabular screw and presented with a painful groin mass 2 months postoperatively. Fukuhara et al [26] published a case of external iliac PSA 2 years after revision THA, thought to be secondary irritation of the artery by an osteophyte. In their case, the patient presented with thrombosis and acute limb ischemia. Other cases of delayed presentation have been in the setting of infection and migrating components [23,27].

External iliac artery PSA can also occur from infection [28–35], acetabular periprosthetic fracture [30], acetabular component migration [27,30–33,36], intrapelvic extravasation of cement [37], prior irradiation [29], and a prominent osteophyte after revision THA [26]. Acetabular screw irritation of the EIA has previously been implicated in the formation of these lesions, but, to our knowledge, this has been universally described in the setting of component migration, and frequently concurrent infection [23,27].

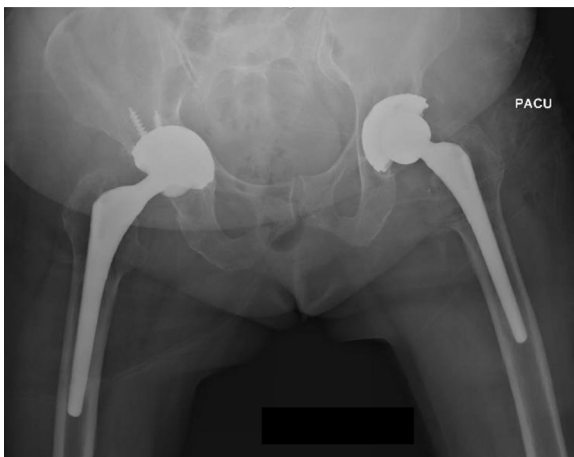


Figure 6. Immediate postoperative anteroposterior radiograph of the pelvis demonstrating removal of hardware with retention of original osteointegrated components.

The current case is unique in that it is the longest reported interval for a PSA to follow apparently uncomplicated THA—15 years after the index procedure. To our knowledge, this is the only reported case of a late vascular injury related to an aseptic THA with well-fixed components. This case is also unique in that it resulted in mass effect and compression of both the femoral vein and nerve. This contributed to the patient's vague presentation and her femoral vein compression was initially misdiagnosed as a DVT and the femoral compression neuropathy was mistaken for lumbar spine pathology. Femoral nerve involvement is an uncommon finding in this setting. Given the rarity of this presentation, it is perhaps not surprising that the patient's diagnosis was delayed. It is interesting to note that the patient's pain and medial thigh numbness preceded other objective clinical findings by nearly 2 months. Medial thigh numbness in and of itself is a unique finding. The differential diagnosis for this pathology includes lumbar radiculopathy as well as obturator or femoral nerve (with saphenous involvement) pathology or compression. The close anatomic relationship between these structures should be recognized and this makes for a difficult diagnosis. Confounding findings (like lumbar stenosis, in this case) can further confuse the clinical scenario. Ultimately, the patient was evaluated in the ED 4 times and by 2 orthopedic surgeons before the correct diagnosis was reached and the correct management undertaken.

We chose to pursue endovascular exclusion of the PSA in this case prior to orthopedic intervention. This approach is supported by the literature as endovascular exclusion is associated with low morbidity and is the least invasive approach to repair the vessel [32,35]. Removing the implicated screw prior to exclusion would lead to uncontrolled hemorrhage. Kong and Knight reported on a case in which rapid blood loss was encountered after removal of a transacetabular screw during a revision of a THA that had been performed 10 years prior. The screw was replaced and provided a tamponade effect but was found to have perforated the internal iliac artery, and staged vascular bypass was successfully performed [38]. In our case, preemptive PSA exclusion prior to screw removal prevented this devastating scenario.

There are multiple learning points from this case. First, delayed presentation of vascular injury associated with THA represents a difficult clinical diagnosis in some patients. However, there have now been well over 20 cases of arterial PSA as a result of THA reported in the literature and many of these present in a delayed fashion. Although more often occurring in septic cases with acetabular component migration, our case demonstrates that this

can also be an aseptic condition with well-fixed components. In a patient presenting with vague complaints of groin pain or discomfort in the trajectory of the femoral or saphenous nerve, without other identifiable etiology, the diagnosis must be strongly considered. Additionally, femoral vein occlusion as a result of mass effect of the PSA is not uncommon in this setting and may be mistaken for a DVT. Second, malpositioned hardware can lead to complications not only acutely, but also in a much delayed fashion. Therefore, when recognized, consideration should be given to removal of clearly aberrantly positioned transacetabular screws, or at the very least, this should prompt closer surveillance. It should be noted that standard AP radiographs will be of low utility in this setting. Galat et al [39] found in their cadaveric study that the inlet and Judet views are the most useful for identifying medial wall penetration. Third, iliopsoas myositis is an uncommon finding in the post arthroplasty patient and this should prompt providers to consider further investigation with ultrasound or advanced imaging. Last, while assumed, continued vigilance must be paid to the quadrant in which acetabular screws are placed and their trajectory. Finally, taken in conjunction with the case reported by Kong and Knight, it is our recommendation that in similar clinical scenarios, endovascular exclusion of the PSA should be completed prior to removal of hardware, so as to prevent catastrophic complication upon removal.

Summary

Vascular injury as a result of THA is uncommon, and those injuries presenting in a delayed fashion are limited to a handful of case reports. This case report detailed a case in which a 70-year-old female presented with groin pain and medial thigh numbness 15 years after a left THA. After initial misdiagnosis, she was found to have a large external iliac PSA as a result of a transacetabular screw penetrating the medial acetabular wall. She was managed with staged endovascular exclusion of the PSA, percutaneous drainage, and revision THA. The postoperative course of both procedures was uneventful. This case demonstrates that in this scenario, staged treatment with endovascular exclusion and revision THA is a viable approach.

References

- [1] Inacio MCS, Graves SE, Pratt NL, Roughead EE, Nemes S. Increase in total joint arthroplasty projected from 2014 to 2046 in Australia: a conservative local model with international implications. *Clin Orthop Relat Res* 2017;475(8):2130.
- [2] Kurtz SM, Lau E, Ong K, Zhao K, Kelly M, Bozic KJ. Future young patient demand for primary and revision joint replacement: national projections from 2010 to 2030. *Clin Orthop Relat Res* 2009;467(10):2606.
- [3] Kurtz SM, Ong KL, Schmier J, Zhao K, Mowat F, Lau E. Primary and revision arthroplasty surgery caseloads in the United States from 1990 to 2004. *J Arthroplasty* 2009;24(2):195.
- [4] Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89(4):780.
- [5] Sloan M, Premkumar A, Sheth NP. Projected volume of primary total joint arthroplasty in the U.S., 2014 to 2030. *J Bone Joint Surg Am* 2018;100(17):1455.
- [6] Mullins MM, Norbury W, Dowell JK, Heywood-Waddington M. Thirty-year results of a prospective study of Charnley total hip arthroplasty by the posterior approach. *J Arthroplasty* 2007;22(6):833.
- [7] Bozic KJ, Kurtz SM, Lau E, Ong K, Vail TP, Berry DJ. The epidemiology of revision total hip arthroplasty in the United States. *J Bone Joint Surg Am* 2009;91(1):128.
- [8] Hwang SK. Vascular injury during total hip arthroplasty: the anatomy of the acetabulum. *Int Orthop* 1994;18(1):29.
- [9] Avisar E, Elvey MH, Bar-Ziv Y, Tamir E, Agar G. Severe vascular complications and intervention following elective total hip and knee replacement: a 16-year retrospective analysis. *J Orthop* 2015;12(3):151.
- [10] Nachbur B, Meyer RP, Verkkala K, Zurcher R. The mechanisms of severe arterial injury in surgery of the hip joint. *Clin Orthop Relat Res* 1979;141:122.
- [11] Parvizi J, Pulido L, Slenker N, Macgibeny M, Purtill JJ, Rothman RH. Vascular injuries after total joint arthroplasty. *J Arthroplasty* 2008;23(8):1115.
- [12] Parvizi J. Vascular injury and orthopaedics. *Arthroplast Today* 2018;4(4):399.
- [13] Aust JC, Bredenberg CE, Murray DG. Mechanisms of arterial injuries associated with total hip replacement. *Arch Surg* 1981;116(3):345.
- [14] Mallory TH, Jaffe SL, Eberle RW. False aneurysm of the common femoral artery after total hip arthroplasty. A case report. *Clin Orthop Relat Res* 1997;338:105.
- [15] Bechet FR, Himmer O, Mairy Y, Looftvoet L. [Arterial false aneurysm after total hip arthroplasty. A case report]. *Rev Chir Orthop Reparatrice Appar Mot* 2004;90(4):365.
- [16] Ha YC, Ahn JO, Jeong ST, Park HB, Koo KH. Iliacus hematoma and femoral nerve palsy after revision hip arthroplasty: a case report. *Clin Orthop Relat Res* 2001;385:100.
- [17] An S, Shen H, Feng M, Li Z, Wang Y, Cao G. Femoral artery injury during total hip arthroplasty. *Arthroplast Today* 2018;4(4):459.
- [18] Preston JS, Mennona S, Kayiaros S. Phlegmasia cerulea dolens and external iliac vein disruption after revision total hip arthroplasty. *Arthroplast Today* 2018;4(4):401.
- [19] Tavares RLP, Arcenio Neto E, Taki W. Total hip revision arthroplasty of high-risk pelvic vascular injury associated with an endovascular approach: a case report. *Rev Bras Ortop* 2018;53(5):626.
- [20] Wasielewski RC, Cooperstein LA, Kruger MP, Rubash HE. Acetabular anatomy and the transacetabular fixation of screws in total hip arthroplasty. *J Bone Joint Surg Am* 1990;72(4):501.
- [21] Keating EM, Ritter MA, Faris PM. Structures at risk from medially placed acetabular screws. *J Bone Joint Surg Am* 1990;72(4):509.
- [22] Shoenfeld NA, Stuchin SA, Pearl R, Haveson S. The management of vascular injuries associated with total hip arthroplasty. *J Vasc Surg* 1990;11(4):549.
- [23] Proschek D, Proschek P, Hochmuth K, Balzer JO, Mack MG, Vogl TJ. False aneurysm of the left femoral artery and thrombosis of the left femoral vein after total hip arthroplasty. *Arch Orthop Trauma Surg* 2006;126(7):493.
- [24] Garrido-Gomez J, Garrido-Gomez MN, Arrabal-Polo MA, Garrido-Pareja F, Linares-Palomino JP. Iatrogenic false aneurysms. A rare complication of hip surgery. *Hip Int* 2012;22(4):397.
- [25] Todd BD, Bintlcliffe IW. Injury to the external iliac artery during hip arthroplasty for old central dislocation. *J Arthroplasty* 1990;5(Suppl):S53.
- [26] Fukuhara S, Kanki S, Daimon M, Shimada R, Ozawa H, Katsumata T. Pseudoaneurysm of the external iliac artery is a rare late complication after total hip arthroplasty. *J Vasc Surg Cases Innov Tech* 2017;3(3):149.
- [27] Bach CM, Steingruber I, Wimmer K, Ogon M, Frischhut B. False aneurysm 14 years after total hip arthroplasty. *J Arthroplasty* 2000;15(4):535.
- [28] Hopkins NF, Vanhegan JA, Jamieson CV. Iliac aneurysm after total hip arthroplasty. Surgical management. *J Bone Joint Surg Br* 1983;65(3):359.
- [29] Scullin JP, Nelson CL, Beven EG. False aneurysm of the left external iliac artery following total hip arthroplasty. *Clin Orthop Relat Res* 1975;113:145.
- [30] Smith GH, Nutton RW, Fraser SC. Iliac artery pseudoaneurysm rupture following excision of an infected hip prosthesis. *J Arthroplasty* 2011;26(6):977.e13.
- [31] Chen JL, Yang TY, Chuang PY, Huang TW, Huang KC. Pseudoaneurysm rupture with hemorrhagic shock in a patient with periprosthetic hip joint infection: a case report. *Medicine (Baltimore)* 2018;97(26):e11028.
- [32] Makar RR, Salem A, McGee H, Campbell D, Bateson P. Endovascular treatment of bleeding external iliac artery pseudo-aneurysm following control of haemorrhage with Sengstaken tube during revision total hip arthroplasty. *Ann R Coll Surg Engl* 2007;89(5):W4.
- [33] Ryan JA, Johnson ML, Boettcher WG, Kirkpatrick JN. Mycotic aneurysm of the external iliac artery caused by migration of a total hip prosthesis. *Clin Orthop Relat Res* 1984:57.
- [34] Sawbridge D, O'Connor OJ, MacEneaney P, Maher MM, Fitzgerald E. Successful endovascular treatment of an infected external iliac pseudoaneurysm with hemorrhage at total hip arthroplasty. *J Vasc Interv Radiol* 2010;21(7):1135.
- [35] Adovasio R, Mucelli FP, Lubrano G, et al. Endovascular treatment of external iliac artery injuries after hip arthroplasty. *J Endovasc Ther* 2003;10(3):672.
- [36] Mody BS. Pseudoaneurysm of external iliac artery and compression of external iliac vein after total hip arthroplasty. Case report. *J Arthroplasty* 1994;9(1):95.
- [37] Tkaczuk H. False aneurysm of the external iliac artery following hip endoprosthesis. *Acta Orthop Scand* 1976;47(3):317.
- [38] Kong EL, Knight MR. Internal iliac artery injury and total hip arthroplasty: discovery after 10 years. *J Arthroplasty* 2013;28(1):196.e15.
- [39] Galat DD, Petrucci JA, Wasielewski RC. Radiographic evaluation of screw position in revision total hip arthroplasty. *Clin Orthop Relat Res* 2004;419:124.