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Case Report

Left Profunda Femoral Artery Pseudoaneurysm After Revision Total Hip Arthroplasty

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ABSTRACT

We present a case report of an 84-year-old male who presented with a profunda femoris artery (PFA) pseudoaneurysm 8 years after the index revision total hip arthroplasty procedure. Failure of revision hardware and subsequent migration of implants led to damage of the PFA and pseudoaneurysm formation. The patient was hemodynamically unstable on presentation and required emergent endovascular intervention. Once medically stabilized, the patient underwent extensive debridement of the aneurysm and hematoma bed and broken hardware was removed to prevent further complications. At 6-month follow-up, the patient was able to mobilize independently and had returned to all prior levels of activities of daily living. We discuss the vascular anatomy of the hip, the paucity of literature on PFA pseudoaneurysm, as well as the likely etiology of total hip arthroplasty failures.

Introduction

Total hip arthroplasty (THA) is one of the most successful and commonly performed orthopaedic surgeries, with *The Lancet* calling THA "the operation of the century" [1]. An average of >370,000 THAs are performed in the U.S. each year, and that number is projected to increase to more than 700,000 by the year 2030 [2]. THA has a 10-year implant survival rate of 95.6% and a 20-year survival rate of 85% [3], making it one of the most reliable procedures performed. The procedure has a low complication rate, with vascular injury being one of the rarest complications at a rate of 0.16-0.25% [4]. Pseudoaneurysms (PAs) are a very rare subset of vascular complications from THA.

There is paucity of reports in the literature that documents PA of the profunda femoris artery (PFA), and all of these were reported to occur in the perioperative, acute or subacute phase of patient care. To our knowledge, there have be no reports in the literature documenting PFA PA occurring in the chronic phase of patient care after THA. We present a case of PFA PA 8 years after the index revision THA.

Case history

An 84-year-old male presenting with left thigh pain, swelling, anemia, and concern for active bleeding was transferred to our institution from an outside hospital. He reported an incident of a "tearing or popping" sensation in his left thigh while at physical therapy 2-3 weeks before presentation. He subsequently had a slow progression of the symptoms stated earlier. Upon arrival, his hemoglobin was 4.9 mg/dL after receiving 3 units of blood at the outside hospital. Owing to concern for active bleeding, advanced imaging was obtained at the outside hospital to determine an etiology. Computed tomography (CT) angiogram of the left lower extremity (Fig. 1) demonstrated an 18.7 cm × 15.4 cm × 14.7 cm PA of the femoral artery with active extravasation and accumulating hematoma. Of note, the CT scan demonstrated failure of prior orthopaedic hardware with medial migration of the broken cerclage wires that were likely in communication with the PA. Vascular surgery was consulted, and the patient was urgently taken to the endovascular suite where diagnostic arteriogram (Fig. 2) identified an intact superficial femoral artery (SFA) and confirmed the PA originating from the PFA with ongoing extravasation. Coil

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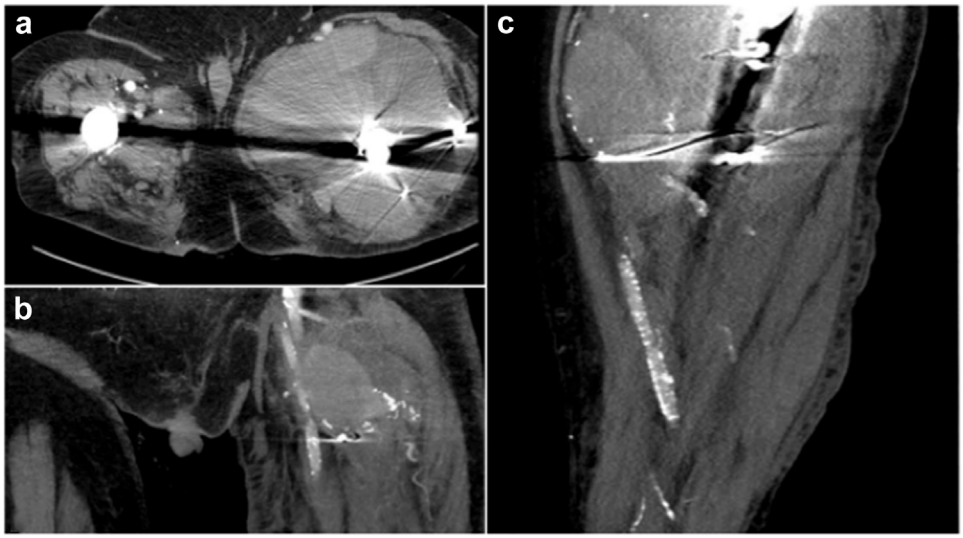

Figure 1. (a)Axial view of the preoperative CT angiogram demonstrating pseudoaneurysm. (b) Coronal view of the preoperative CT angiogram demonstrating pseudoaneurysm. (c) Sagittal view of the preoperative CT angiogram demonstrating pseudoaneurysm.

embolization failed to exclude the PA because of the wide arterial wall defect and morphology of the PA neck. Multiple covered stents (Viabahn W.L. Gore, Flagstaff, AZ) were deployed to exclude the PA, restore arterial integrity, and resolve further extravasation of blood into the thigh (Fig. 3). After the procedure, the patient was improved, was hemodynamically normal, and had a stable anemia. Physical examination demonstrated a large swollen left thigh that was compressible with no pulsatile mass and no clinical signs of compartment syndrome. Prior surgical incisions were well healed without erythema, induration, or drainage. Sensory and motor examinations were normal with palpable distal pulses. Plain radiographs (Fig. 4) of the pelvis and left hip demonstrated revision THA implant, broken cerclage wires, complete dissociation of the lateral proximal femoral plate, and lysis of a significant amount of bone from the greater trochanter. Despite failure of the plate and cerclage wires, the femoral and acetabular components appeared stable.

The patient's medical history was significant for atrial fibrillation, coronary artery disease, previous myocardial infarction, and heart failure requiring Eliquis. His orthopaedic history included a primary left THA performed 8 years prior that was complicated by a fall 1 month postoperatively. During the fall, he sustained a periprosthetic proximal femur fracture that required operative intervention. He subsequently underwent revision THA in which the acetabular component was retained, but the femoral component required a revision stem, lateral proximal femur or greater trochanteric hook plate placement, and cerclage wire fixation. The patient had an uneventful postoperative course and returned to his activities of daily living. Six years after revision THA, the patient fell again and imaging demonstrated failure of his proximal femur plate and cerclage wires. During subsequent hospitalization, discitis of the lumbar spine was determined to be the cause of the fall. Owing to the patient's declining mobility and comorbidities, it was decided to forego surgery to address the broken hardware, and his discitis was treated with IV antibiotics. Once he clinically improved, he began physical therapy and rehabilitation and was able to regain mobility with the assistance of a walker. Ultimately, he was discharged and was living at home before his presentation to our institution.

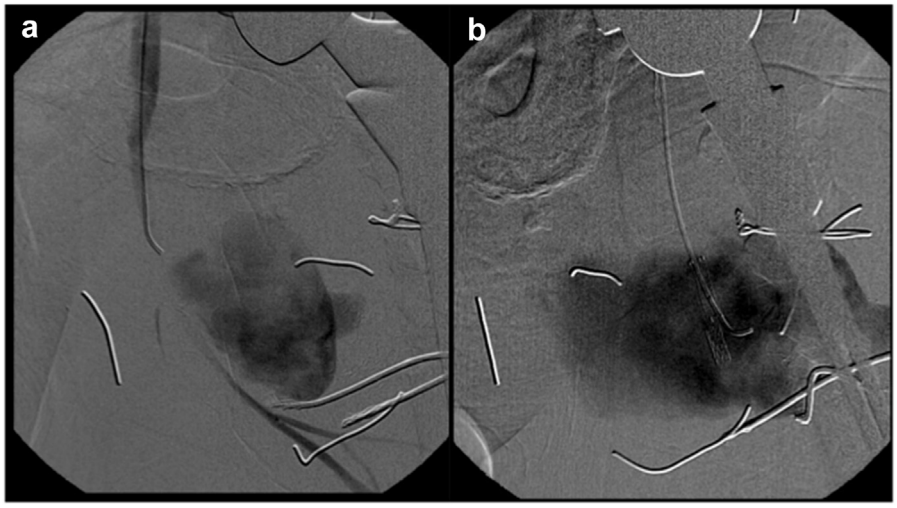

Figure 2. (a) Anteroposterior arteriogram of the left hip demonstrating pseudoaneurysm of the profunda femoris artery. (b) Lateral arteriogram of the left hip demonstrating pseudoaneurysm of the profunda femoris artery.

Figure 3. Arteriogram of the left hip demonstrating endovascular repair of the profunda femoris artery.

Upon stabilization of his PA and acute blood loss anemia, we recommended that removal of the hardware was in the patient's best interest to prevent further migration and neurovascular complications. Four days after endovascular intervention, he was brought to the operating room for broken hardware removal and the hematoma was evacuated and drained (Figs. 5 and 6). The acetabular and femoral components were stable and thus retained. The incision was dressed with a negative-pressure wound dressing. Intraoperative cultures of the hematoma and hip joint fluid were obtained and subsequently grew methicillin-resistant Staphylococcus epidermidis (MRSE). Our Infectious Disease colleagues recommended a 6-week course of IV antibiotics for treatment. The remainder of the hospital stay was uneventful, and the patient was discharged to a rehabilitation facility 1 week postoperatively.

After discharge, the early postoperative course was complicated by surgical wound dehiscence requiring return to the operating room for irrigation and wide debridement, placement of local antibiotics, and a course of IV antibiotics followed by oral suppressive antibiotics.

At 6-month office follow-up, the patient had continued to improve. He was able to mobilize independently with a rolling walker. The incision remained well healed without erythema, fluctuance, or induration. The hip was nontender to palpation, and he was pain free with range of motion and weight-bearing activities. He was scheduled for subsequent follow-up in 1 year.

Discussion

Vascular injury after THA is a very rare occurrence [4] that typically happens within the intraoperative or perioperative time period [5]. The timing of this vascular injury, occurring over 8 years after revision THA was performed, is what makes this case unique. The other factor making this case unique was that the vascular injury was a PA of the PFA and its etiology was medial migration of a broken cerclage wire directly into the artery.

The vasculature about the hip joint is quite robust and complex [6]. The common femoral artery gives rise to the PFA and the SFA. The SFA has five branches that mostly supply the pelvic region before tracing down the thigh toward the adductor hiatus to become the popliteal artery [6]. The PFA has three primary branches: the lateral and medial femoral circumflex arteries that give primary blood supply to the hip and the adductor perforating arteries that supply the thigh as it descends the leg [6].

PA is a false aneurysm that occurs after a localized arterial wall injury. Local extravasation of blood outside the arterial wall is confined and controlled by the pseudocapsule that develops. The management of PA varies widely to include observation, ultrasound-guided decompression with or without thrombin injection, endovascular intervention, and open surgical repair. Complicated femoral PA is defined as the presence of any of the following clinical features: hemodynamic instability, neurologic deficit or pulse deficit attributable to the PA, expanding hematoma, extensive skin and subcutaneous damage, concern for soft-tissue infection, cellulitis, and purulent drainage. In general, patients with complicated PA require surgical repair. In the absence of

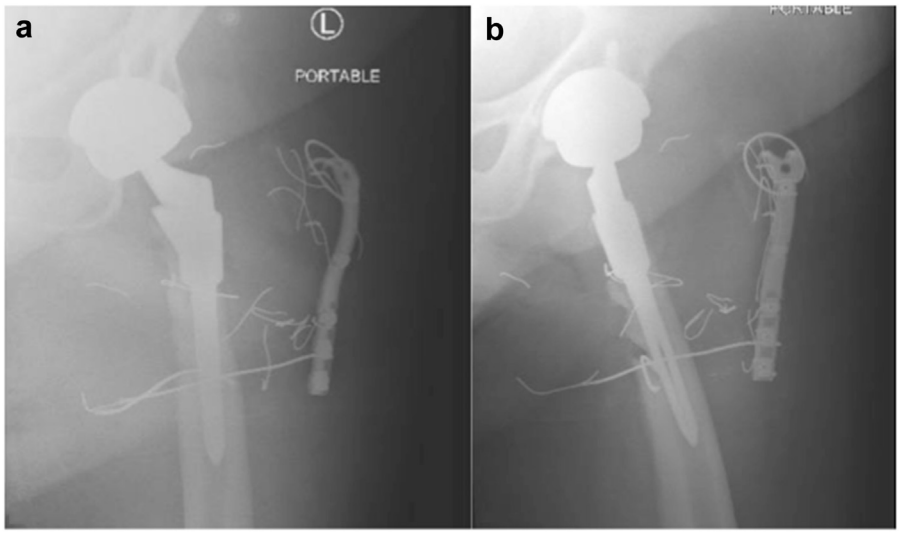

Figure 4. (a) Preoperative anteroposterior radiograph of the left hip demonstrating hardware failure with migration. (b) Preoperative lateral radiograph of the left hip left hip radiograph demonstrating hardware failure with migration.

Figure 5. Photograph of removed hardware.

infection, endovascular techniques can be considered, particularly if the patient is at high surgical risk. Endovascular options include coil embolization or a covered stent to exclude the PA from circulation.

Failure of orthopaedic implants is uncommon, but determining the cause of failure is paramount to the success of revision surgery. This is especially true in cases of revision THA. The most common causes of primary THA failure in order of occurrence include aseptic or mechanical loosening, periprosthetic fracture, infection, particle wear—causing osteolysis, dislocation or instability, surgical technique error, and implant breakage [7]. The causes of failure in cases of revision THA vary slightly with infection being the most common, followed by instability and aseptic or mechanical loosening [8].

The etiology of our patient's primary THA failure was clearly delineated by the femoral component loosening secondary to a periprosthetic fracture sustained after a ground-level fall. The etiology of the failure of his revision THA is less clear owing to the chronic nature of his presentation and his complicated medical comorbidities. Particularly confounding in this case was the patient's previous episode of discitis which grew the same organism that was obtained from intraoperative cultures (MRSE). In this case, the patient's discitis was treated with antibiotics and his broken hardware was initially not addressed secondary to his poor medical state at the time and medical comorbidities. In hindsight, an intervention at this time could have possibly addressed the broken hardware and prevented migration causing his PA. In our opinion, it is very possible that given his bacteremic state, it seeded his hip hardware. We are quite confident that the cause of the PA itself was secondary to wire migration. Other possibilities include 1: particle wear from the metal-on-metal THA leading to metallosis, osteolysis of the proximal femur, and subsequent internal fixation failure; 2: chronic nonunion of the periprosthetic fracture, fracture fragment resorption, and internal fixation failure; 3: chronic infection-likely seeded secondary to the patient's history of discitis and bacteremia, causing osteomyelitis with erosion of the proximal femur and internal fixation failure; 4: any or all of the above, leading to internal fixation failure, implant migration, PA, and hematoma formation with an infected hematoma. What is known is that the intraoperative cultures grew MRSE and on the preoperative CT angiogram air could be seen in the subcutaneous tissue, thus implicating infection as one of the causative features.

Cerclage fixation constructs have long been used in primary and revision THA for their known ability to provide secure fixation of the proximal femur when traditional lag screw fixation is not feasible. Traditionally the debate has been whether to use monofilament wire or multifilament cable. Monofilament wire is weaker and more susceptible to kinking but has a much lower profile and produces less debris [9]. Cables have superior strength but cause significantly more debris generation and third-body polyethylene wear [9]. A new alternative to this debate is the use of a braided tape suture cerclage system. Braided tape suture cerclage system (FiberTape: Arthrex, Naples, FL) has been shown to have up to 4 times greater load to failure and less displacement than monofilament wire with equally low profile and less debris generation [10,11].

Possibly more controversial is the topic of removal of orthopaedic implants. Clinical indications are not well established, and there is paucity of data to determine if routine hardware removal is appropriate. Some argue that routine removal of implants is unnecessary and wastes healthcare dollars, resources, and man-hour or work-time, which puts patients at risk of undue complications from additional surgery [12,13]. Others support removal of

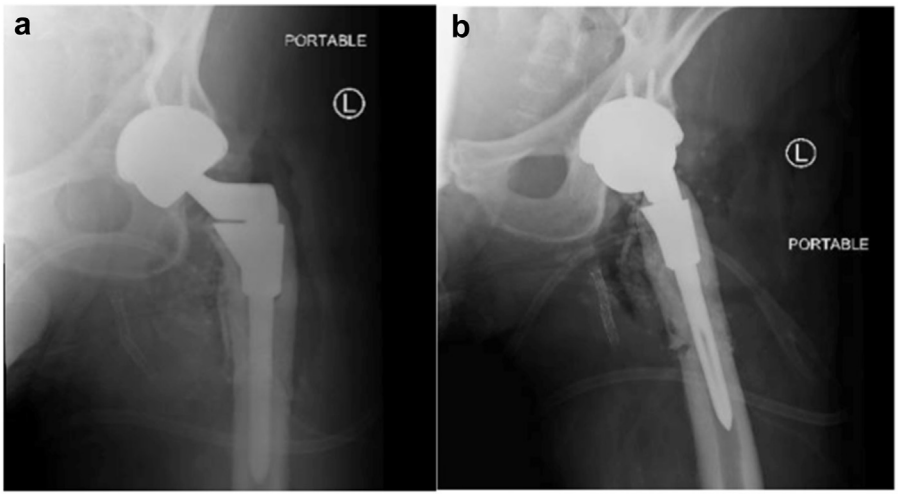

Figure 6. (a) Postoperative anteroposterior radiograph of the left hip. (b) Postoperative lateral radiograph demonstrating removal of hardware, debridement, and local antibiotic placement.

implants defending the right of patient autonomy and overall patient satisfaction [14]. The most commonly documented reasons for hardware removal are mechanical symptoms, infection, and hardware failure [15]. Ultimately it comes down to the doctor-patient relationship, and a joint decision must be made to determine the risks and benefits of implant removal vs watchful waiting.

Wound healing is essential to good outcome in THA. Every patient undergoing arthroplasty should be assessed for risk factors to wound healing before any procedure. Risk factors can be classified into two categories: those intrinsic to the patients and extrinsic within the environment. Intrinsic factors known to increase risk to the patient include poor nutrition revealed by low total lymphocyte counts, low transferrin, low albumin, and prealbumin; comorbidities of diabetes mellitus with Hg A1C >7%, rheumatoid diseases, renal or liver disease, corticosteroid medication, immune-compromised states, body mass index >40 kg/m^2, and smoking; local factors of extensive scarring, lymphedema, poor vascular perfusion, and excessive adipose tissue [16]. Extrinsic factors include use and timing of prophylactic antibiotics, meticulous handling of soft tissues, proper inclusion of prior incisions, laminar flow operating rooms, and potency of thromboembolic chemoprophylaxis [16]. In revision THA, these factors are paramount. Negative-pressure wound therapy (NPWT) has become an integral adjunct for revision THA. Proposed mechanisms of action for NPWT include macrodeformation and microdeformation of the wound bed, fluid removal, and stabilization of the wound environment [17]. In a prospective, randomized clinical trial for high risk, revision arthroplasty NPWT has been shown to decrease wound complication rate and decrease reoperation rates when compared with standard silver-impregnated occlusive dressings [18].

Summary

THA is one of the best procedures that we can offer in the care of our patients, with high success rates and infrequent complications. Although quite rare, vascular injury should not be neglected from the clinician's differential when a patient presents with postoperative complications, both in the acute and chronic time frame. In the setting of broken hardware, close follow-up with regular imaging is necessary to monitor for implant migration. In the setting of concurrent infection, it is important to perform an extensive workup to exclude infection of the arthroplasty hardware in question. In this case, a high index of suspicion and earlier surgical intervention may have prevented subsequent vascular injury secondary to hardware failure. A healthy doctor-patient relationship will aid in the conversation of the risks and benefits of hardware removal and allow for the decision to be made in the patient's best interest.

Conflict of Interests

The authors declare there are no conflicts of interest.

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