



Case Report

Occlusion of an Aortobifemoral Graft after Revision Total Hip Arthroplasty

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ABSTRACT

With the aging population, the demand for total hip arthroplasty is rising. Improvements in arthroplasty techniques and design allow for total hip arthroplasty to be increasingly performed in older patients and those with multiple comorbidities. Complications are rare in young and healthy patients; however, there is greater risk in patients with multiple medical comorbidities and those who have had prior revision procedures. Large-vessel thrombosis is an especially rare, but potentially devastating, complication, particularly in patients with existing major-vessel bypass grafts. Only 3 case reports of major-vessel graft occlusion after total hip arthroplasty have been reported in the literature, and none after revision. In this article, we report a case of occlusion of an aortobifemoral graft after revision total hip arthroplasty for periprosthetic joint infection.

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Introduction

Total hip arthroplasty (THA) is one of the most successful and common procedures in modern orthopedics. With the aging population, the demand for hip replacement is increasing, with 635,000 primary hip replacements being projected to be performed in 2030, a 71% increase compared to 2014 [1]. Advances in surgical technique, implant design, and postoperative protocols have improved outcomes and safety profiles. This has led to hip arthroplasty being safely performed in older patients, even in those with multiple comorbidities. Complications are generally rare in younger and healthy patients. However, the risk of perioperative complications is greater in patients with multiple comorbidities and in patients who undergo multiple revision procedures [2–7]. Large-vessel thrombosis is a particularly rare but potentially devastating complication—especially in patients with previous major vessel bypass grafts. Only 3 case reports of major bypass graft occlusions after THA have been reported in the literature [8–10],

and none to our knowledge after revision THA (Table 1). In this article, we report a case of an arterial thrombosis occurring in a patient with an aortobifemoral graft after revision THA for periprosthetic joint infection (PJI).

Case history

An 85-year-old Caucasian male patient presented to our institution with a history of a prior THA at an outside hospital in 1997, with subsequent head and liner exchange from metal-on-metal to ceramic on polyethylene in 2014 because of elevated cobalt and chromium ions. His past medical history included atrial fibrillation, congestive heart failure, peripheral vascular disease, abdominal aortic aneurysm, renal artery stenosis, chronic kidney disease, hypertension, chronic obstructive pulmonary disease, and prostate cancer. He was anticoagulated at presentation with rivaroxaban for his atrial fibrillation. Given his extensive history of severe atherosclerotic disease, he had previously undergone several vascular procedures including abdominal aortic aneurysm repair and aortobifemoral bypass. Approximately 6 months before this initial clinic presentation, the patient had been hospitalized at an outside hospital with *Escherichia coli* (*E. coli*) sepsis secondary to pneumonia and urinary tract infection. During this hospitalization, he developed right hip pain. However, no workup was completed at

Consent: The patient described in this case report consented to the preparation and publication of this article.

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Table 1
Literature review of major bypass occlusion after total hip arthroplasty.

Article	Graft	Indication for arthroplasty	Surgery	Approach	Event	Intervention
Parfenchuck et al., 1994 [9]	Iliofemoropopliteal artery bypass graft	Avascular necrosis	Uncemented primary THA	Unspecified	Intraoperative thrombosis of iliofemoropopliteal bypass graft	Thrombectomy
Trousdale et al., 1999 [8]	Aortobifemoral bypass graft	Osteoarthritis	Uncemented primary THA	Posterior	Postoperative thrombosis of aortofemoral bypass graft	Thrombectomy
Park et al., 2012 [10]	Femoropopliteal bypass graft	Femoral neck fracture nonunion	Uncemented primary THA	Posterolateral	Postoperative thrombosis of femoropopliteal bypass graft	Thrombolysis

THA, total hip arthroplasty.

the time. Two months after this hospitalization, he was readmitted with worsening right hip pain and swelling and was subsequently transferred to our institution. His workup included serum laboratory work and a fluoroscopically guided hip joint aspiration. He was subsequently diagnosed with a right THA PJI, after cultures grew *E. coli*. The plain radiographs at the time of admission demonstrated a well-fixed and well-aligned uncemented right THA with a fully porous coated cylindrical stem (Fig. 1). There was evidence of extensive proximal femoral osteolysis, particularly around the greater and lesser trochanters. There were also 3 cerclage cables around the femur just distal to the tip of the stem. Review of the initial operative report from the index procedure revealed that these cables were placed when an intraoperative nondisplaced fracture was noted just distal to the tip of the stem. Per the notes from the initial surgeon, the fracture healed uneventfully, and the patient went on to a full recovery.

After confirmation of the diagnosis of PJI, the patient underwent irrigation and debridement, removal of the THA with an extended trochanteric osteotomy to remove the well-fixed fully porous coated cylindrical femoral stem, and placement of an antibiotic-impregnated cement spacer. Postoperative plain radiographs showed excellent position of the antibiotic spacer and anatomic alignment of the osteotomy (Figs. 2 and 3). He was subsequently treated with 6 weeks of intravenous antibiotics followed by a further 6 weeks of oral antibiotics as per the recommendations of our infectious disease team. After a 2-week antibiotic holiday, he underwent fluoroscopically guided aspiration of his right hip. His serologic markers demonstrated a significant downward trend, synovial fluid cell count and differential normalized and alpha defensin testing, and bacterial cultures were found to be negative. It was determined that he had cleared

his infection, and the second stage of his reimplantation was scheduled.

Physical examination during clinic visits before his second-stage surgery revealed a well-healed posterolateral scar without erythema, warmth, or other signs of infection or complication. He had no pain with passive range of motion of the hip and was able to flex to 110°, with 20° of internal rotation and 40° of external rotation. There was no appreciable leg length discrepancy. His feet were warm and well perfused clinically with palpable dorsalis pedis and posterior tibial pulses. Radiographs revealed the cement spacer remained in appropriate position, but a fracture of the greater trochanter with significant displacement was noted (Fig. 4). Before surgery, the patient was evaluated by his vascular surgeon and cardiologist and felt to be optimized as much as possible before reimplantation. They recommended no further workup or interventional action before the second stage of his replant. The rivaroxaban was discontinued 72 hours before the second-stage surgery.

The patient was taken back to the operating room and underwent a revision right THA via posterior approach through the prior posterolateral scar, including irrigation and debridement, removal of the antibiotic impregnated spacer, and reimplantation of the right THA with a noncemented acetabular component with 2 screws for secondary fixation and a proximal femoral replacement (Fig. 5). There were no intraoperative complications, and the patient tolerated the procedure well, with an estimated blood loss of 500 cubic centimeters. He was taken to the postanesthesia care unit and transferred to the floor in stable condition, with palpable dorsalis pedis and posterior tibial pulses. His postoperative hemoglobin (Hgb) in the postanesthesia care unit was 7.4 (from a preoperative Hgb of 9.7). Given his extensive history of vascular disease and atrial fibrillation, the patient's preoperative

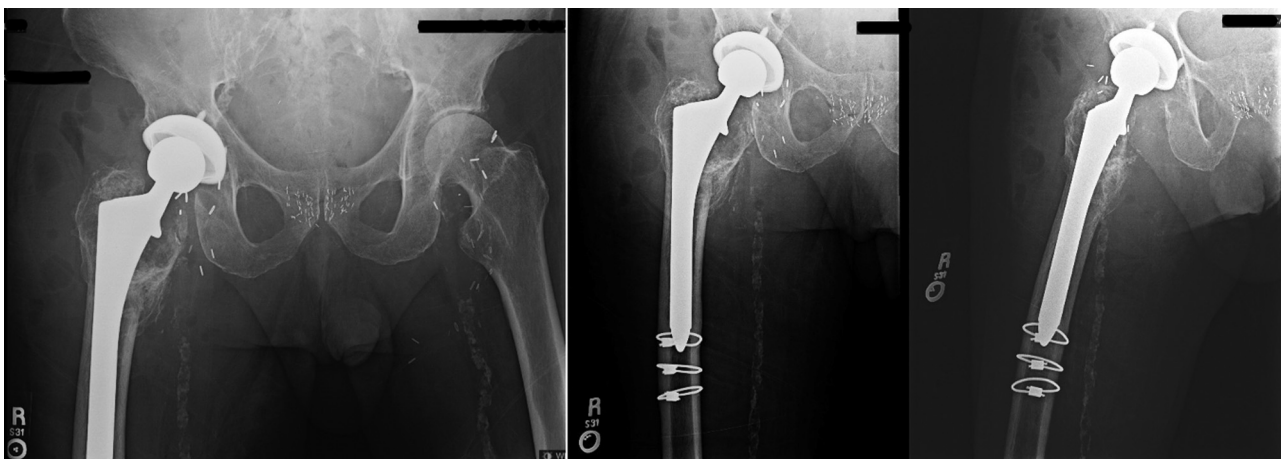


Figure 1. Preoperative radiographs showing well-fixed and well-aligned uncemented right total hip arthroplasty with fully porous coated cylindrical stem. Note extensive proximal femoral osteolysis and cerclage cables at distal extent of stem from index procedure.

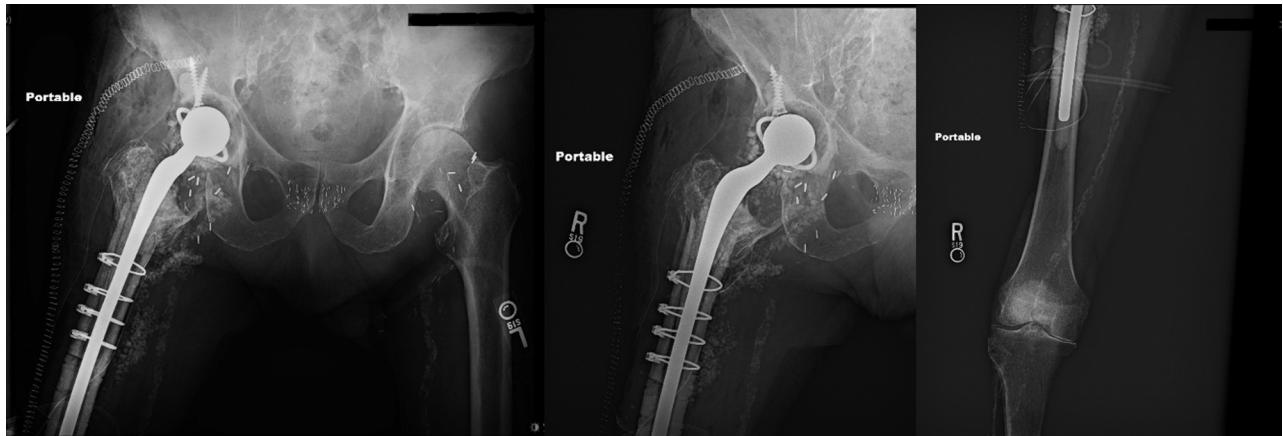


Figure 2. Immediate postoperative radiographs showing excellent position of the antibiotic spacer and anatomic alignment of the osteotomy.

anticoagulation, rivaroxaban was reinitiated at noon of postoperative day one (POD 1), however at a lower dose (10 mg daily instead of 20 mg) given his low Hgb.

On POD 2, the patient's Hgb was found to be 5.8, and he was transfused 2 units of packed red blood cells with an appropriate response. Of note, despite this low Hgb, the patient's systolic blood pressure was consistently in the 100s-140s, without any periods of hypotension.

On the morning of POD 2, routine postoperative labs revealed his white blood cell count had increased from 15 on POD 1 to 25, and he was noted to have loose bowel movements. *Clostridioides difficile* testing was found to be positive, and the patient was started on oral vancomycin. On afternoon rounds, the patient's right lower extremity was found to be cool to the touch compared with the left lower extremity. Distal pulses which were palpable on morning rounds were now no longer palpable. He denied any significant discomfort or pain and further denied any weakness or changes in sensation from baseline. A stat computed tomography (CT) angiography was obtained and revealed an occlusion in the right limb of his aortobifemoral graft (Fig. 6). Given these findings, the patient was taken emergently to the interventional vascular suite with the vascular surgery team and underwent an attempted percutaneous thrombectomy via the left brachial artery. However, this was aborted after an arterial injury was noted in the brachial artery. The

patient was then taken to the operating room and underwent an open repair of his left brachial artery and then open groin exploration with open balloon thrombectomy of the right aortobifemoral graft. An intraoperative angiogram confirmed restoration of blood flow to the right lower extremity (Fig. 7). The patient was extubated and taken to the intensive care unit postoperatively for close monitoring. He was started on a heparin drip, and the rivaroxaban was held. After several days, the heparin drip was stopped, and he was restarted on the rivaroxaban. His vascular examination remained stable, compartments remained soft, and the patient recovered well and was discharged from the hospital 2 weeks later to a skilled nursing facility. At his most recent clinic visit, 8 months postoperatively, he was doing well. He was pain-free and was ambulating with the use of a walker and an ankle-foot orthosis because of some residual weakness in the right foot. He otherwise had no complaints and no signs of recurrent infection or compromised blood flow to his right lower extremity. He remains on chronic anticoagulation, currently on warfarin.

Discussion

Arterial thrombosis after THA is a rare but potentially limb and even life-threatening emergency. Prompt diagnosis and intervention is vital to avoid long-term complications. To our knowledge,



Figure 3. Two-week postoperative radiographs again showing excellent position of the antibiotic spacer and anatomic alignment of the osteotomy.



Figure 4. Preoperative radiographs revealing appropriate position of antibiotic spacer and now with fracture of the greater trochanter. Note extensive vascular calcifications.

this case represents the first report of thrombosis of an aortobifemoral graft after revision THA. Only 3 case reports of major vascular bypass graft occlusion after THA have been reported in the literature (Table 1), and none after revision THA.

In a 1999 article, Trousdale et al. [8] describe the case of a 63-year-old gentleman who had previously undergone an aortobifemoral bypass. Preoperative noninvasive vascular studies revealed moderate occlusive disease in the bilateral lower extremities. However, a duplex scan showed both femoral graft anastomoses to be patent, without significant stenosis. The patient underwent a primary THA. However, the patient was found to have an occlusion in the right limb of the aorto-femoral bypass after complaining of right foot and calf pain, and foot numbness for approximately a week after surgery. A large, organized thrombus was found during surgical thrombectomy. Ultimately, the patient recovered well. In the case report, the authors speculated that the flexed, adducted, and internally rotated position required during the posterior approach may have occluded the graft and contributed to the development of a thrombus. They recommended consideration of

an anterior approach in patients with an aortobifemoral bypass graft [8].

Parfenchuck and Young [9] reported an intraoperative occlusion of an iliofemoro-popliteal bypass graft during a primary THA in a 61-year-old male. At the end of the operation, the ipsilateral foot was noted to be cool and bluish, without palpable or dopplable pulses. Vascular surgery was consulted emergently into the operating room, and a groin exploration revealed a fresh thrombus which was removed. The patient subsequently recovered well. The authors did not specify the approach used in this case; however, they did comment that flexion and internal rotation may have contributed to the occlusion in their case, suggesting that a posterior approach was used. The authors suggested minimizing any extreme positioning if possible, in patients with bypass grafts [9].

In their 2012 article [10], Park et al. describe the case of a 77-year-old male with a history of femoro-popliteal bypass who underwent left THA for a femoral neck fracture nonunion after failed cannulated screw fixation 6 months prior. The patient underwent a cementless left THA using a posterolateral approach. Four hours

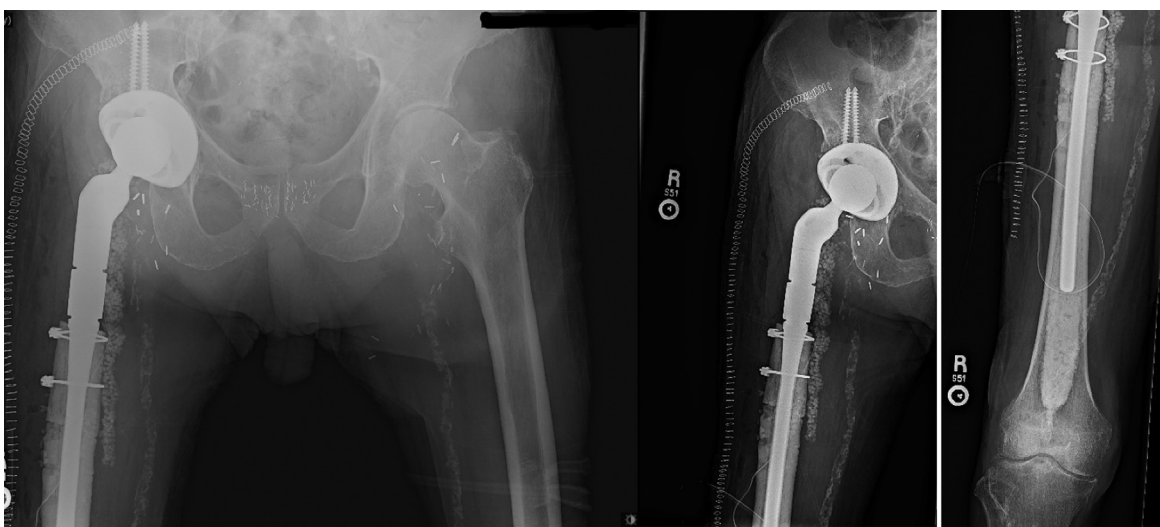


Figure 5. Postoperative radiographs showing patient now status-post replant proximal femoral replacement. Note extensive vascular calcifications.



Figure 6. Computed tomography angiogram demonstrating occlusion of the right limb of the aortobifemoral graft.

after surgery, he began to complain of inability to dorsiflex his ipsilateral ankle and numbness in his foot. Computed tomography angiography revealed a large thrombus in the left common iliac artery from the origin of the external iliac to the bypass graft. The patient underwent successful thrombolysis by interventional radiology approximately 12 hours postoperatively. The patient complained of some mild limping postoperatively, but otherwise made a full recovery [10].



Figure 7. Intraoperative angiogram showing re-established blood flow in the right limb of the aortobifemoral graft.

Arterial thrombosis is a rare complication after THA, with potentially disastrous consequences. Patients may present in a variety of ways, including complaints of increasing pain, numbness, tingling, weakness, or as in this case, have no obvious subjective complaints—with physical examination findings being the first and only clue to the underlying pathology. As such, the importance of a thorough and attentive preoperative and postoperative physical examination, including neurovascular exam, cannot be over-emphasized. When performing THA in patients with an extensive history of vascular disease or previous major vessel graft, we recommend a multidisciplinary approach. These patients often have several medical comorbidities, and careful management of these conditions is essential in the postoperative setting. A careful assessment and documentation of the neurovascular status (especially of the operative limb) should be performed, and consideration should be made to include imaging studies such as ultrasound or CT angiography preoperatively. If a graft is in place, preoperative evaluation and consultation with the patient's vascular surgeon should be considered to optimize the patient before surgery and ensure further vascular procedures are not required preoperatively.

For patients with vascular bypass grafts, Trousdale et al. [8] recommended avoiding a posterior approach to minimize the flexed, adducted, and internally rotated position, as they believe this position may contribute to the development of vascular thrombosis. However, this may be difficult in the revision setting, where the posterior approach allows for an extensile exposure which is commonly needed for complex revision hip replacement procedures. For the subject of this case report, the patient had undergone multiple revision procedures via a posterior approach. It was the senior author's decision to continue to use a posterior approach for the ensuing procedures to perform an extended trochanteric osteotomy to safely remove the well-fixed fully porous coated stem as well as for the subsequent reimplantation with a proximal femoral replacement. It is unclear whether the positioning of the operative limb during the posterior approach contributed to the development of the thrombus. Nonetheless, we recommend that care should always be taken with the operative limb to avoid any extreme positioning—especially in those patients with severe arterial disease or patients who have existing vascular bypass grafts present. Should complications arise, we recommend prompt consultation with vascular surgery to provide assistance should an arterial injury or occlusion be suspected.

The American populace is aging and living longer, leading to older patients with multiple comorbidities seeking total joint replacement. As the number of primary procedures increases, so too will the number of revision procedures [1-3,5,6]. The result of these trends leads to increased complications as both primary and more complex revision arthroplasties are completed in an older and more comorbid patient population [4,7]. As such, at our institution, a multidisciplinary approach is used for all patients undergoing arthroplasty, including internal medicine-trained hospitalists being routinely consulted for postoperative medical comanagement. In addition, our anesthesiology team offers a specialized preoperative clearance clinic for high-risk patients. Consultations with all other medical and surgical specialties, including vascular surgery, are also available, although not routinely obtained. Patients are cared for postoperatively in an orthopaedic wing of the hospital, with orthopaedic specialized nursing, physical/occupational therapy, and case management staff, and closely monitored throughout their hospital stay.

Summary

As our technologies and surgical techniques continue to advance, and our management of complex patients improves, we will continue to offer primary and revision arthroplasty to an older

and more comorbid population. Unfortunately, complications will occur. However, with a thorough preoperative assessment and optimization and attentive postoperative care via a multidisciplinary approach, risks can be minimized, and we can continue to care for a wider patient population.

Conflict of interests

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Please see attached disclosure forms.

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