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Conclusion: After thorough research review, only two instances of aortobifemoral bypass graft occlusion were found after total hip arthroplasty. This is the first case report of an arterial thrombosis of an aortobifemoral bypass graft in a total hip via an anterior (modified Hardinge) approach to the hip. It is also the first case report of a revision procedure causing thrombosis in this graft type. This paper illustrates the importance of vigilance of vascular complication in post-surgical total joint patients.

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CASE REPORT

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Keywords: Aortobifemoral bypass graft, Total hip arthroplasty, Thrombosis, Vascular injury

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INTRODUCTION

Total hip arthroplasty (THA) is a common procedure in orthopedics that relieves pain and improves function in patients that suffer from arthritis of the hip. Secondary to the aging U.S. population, there is an increased need for arthroplasty with projected estimates in total hip arthroplasty expected to increase 174% from 209,000 in 2005 to 574,000 by the year 2030 [1]. As this population ages, more pre-existing medical conditions will be present in the patient base, potentially increasing the surgical risk [2–4]. The risk of vascular injury is increased in patients with pre-existing vascular disease symptoms such as sensory disturbances, claudication, atherosclerosis, or decreased distal pulses [5–6]. Total hip arthroplasty is considered a safe, elective procedure but is not without fatal complications [7–9]. Compromise of the vascular supply is a complication with serious consequences. Specifically, acute arterial thrombosis is a life- and limb-threatening injury, and although rare, can occur during THA [5–6]. Arterial complication associated with THA are reported to be 0.08% [5]. Vascular injuries are reported in literature secondary to indirect trauma from retractors, removal of cement during revision surgery, and component migration [10–14]. Other, less common injuries include direct trauma, dislocation techniques, excessive reaming of the acetabulum and placement of acetabular screws [15–19]. Thromboembolic complications appear to be the most common type of vascular insult in THA accounting

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for nearly 50%. The external iliac vessels have the highest incidence of involvement [20]. It is uncommon to involve the iliofemoral artery or superficial femoral artery [14, 21]. The purpose of this study is to report the case of a patient with pre-existing vascular disease and history of aortobifemoral bypass graft, who had an acute thrombosis during revision total hip arthroplasty via the modified Hardinge approach. The patient provided written, informed consent for print and electronic publication of this case report.

CASE REPORT

A 58-year-old male presented to the adult reconstructive clinic for evaluation of his left hip. The patient previously had right and left THA performed in 2003 and 2004, respectively, for a vascular necrosis secondary to alcohol use. The patient had a previous aortobifemoral bypass graft performed in 1999 secondary to peripheral vascular disease (PVD). In 2010, the patient was seen for follow-up by vascular surgery and had computed tomography angiography (CTA) to evaluate the graft. It was negative for disease despite continued tobacco abuse.

On examination his left leg measured 1.5 centimeters longer than his right leg. He was motor and sensory intact. Posterior tibial pulses were palpable, dorsalis pedis listed as faint. Left hip flexed to 90°, ER 30°, IR 10°, abduction 35° and adduction to 20°. The patient had pain on terminal external rotation, internal rotation and compression of hip joint that reproduced pain of chief complaint.

Radiographs were obtained and in comparison to images from 2010 the left acetabular shell appeared to be migrating into a more vertical position over time. The femoral component appeared to be stable without loosening (Figure 1). Laboratory evaluation was negative for infection. The patient was counseled about the risks and benefits of surgery and was offered revision THA with acetabular component revision, polyethylene liner and femoral head exchange.

Prior to revision, patient underwent evaluation by cardiology which showed negative stress test ECG and normal echocardiogram. PVD was mentioned, but further evaluation was not recommended. Patient underwent uneventful acetabular component revision, polyethylene liner and femoral head exchange. It was found intraoperatively that femoral component was solid, there was minimal trunnion wear and an intraoperative decision was made to keep the femoral component (Figure 2).

Six weeks after procedure patient presented with radiographs showing failed left, revision THA (Figure 3). In this image, we can see the component is loose and migrating to a more vertical position. The patient denied trauma, and repeat revision was scheduled.

Three months after initial procedure, a second revision for failed THA was performed (Figure 4). The patient was positioned supine and the modified Hardinge approach was utilized. Frozen specimens were negative, while waiting for the pathology results the leg was positioned in extension. The procedure was uneventful. Leg lengths were equal at procedure completion. Patient did well in post-anesthesia care. Fourteen hours postoperatively patient complained of cramping, numbness and tingling, left lower extremity. Patient was evaluated immediately and examination revealed cold left lower extremity without palpable or dopplerable pulses. Motor was intact, compartments were soft with no pain on passive stretch. CTA showed occlusion of left limb of aortobifemoral bypass (Figures 5 and 6). Patient urgently underwent an open left aortoiliac, femoropopliteal thrombectomy with bovine patch angioplasty and four compartment fasciotomy. Removal of entire clot and patency of graft was confirmed at the end of the procedure with on-table angiography. Postoperatively, the patient was monitored in the surgical intensive care unit, and had resolution of ischemic symptoms with palpable posterior tibial pulses and Dopplerable dorsalis pedis pulses. Patient passed physical therapy recommendations prior to discharge. Upon follow-up the patient was ambulating without limitations and had no ischemic symptoms.

DISCUSSION

Arterial complications after THA are relatively rare but potentially devastating. Vigilance by all members of the care team is essential in the care of the patient.

Figure 1: Left hip showing lucency around cup and mild vertical migration (anteroposterior pelvis initial at presentation).

After reviewing available literature, only two instances of arterial thrombosis in THA have been identified in patients with aortobifemoral bypass grafts. Two of the three, including this study, were left sided [14, 22]. Left sided injury is reported as more common secondary to the leftward lateral position of the aortic bifurcation [10]. This is the first reported vascular injury from an anterior approach, specifically the modified Hardinge in supine position. A posterior approach using flexion, adduction and internally rotated position was reported by one study as the causative factor for occlusion [14]. The second study does not explicitly state type of approach, but the patient was in the lateral decubitus position and marked flexion and internal rotation was used during the procedure [22]. One retrospective series of ten THAs was performed utilizing the anterior approach in the presence of aortobifemoral bypass graft and none led to thrombosis [14]. Revision surgery potentially increases the rate of vascular injuries [6]. Ischemia may occur with stretching of diseased vessels contracted by scar, especially if correction of contracture or lengthening occurs during surgery [14]. In our case, we shortened the limb by 1.5 cm. The lateral position was not used, and significant flexion and internal rotation was not required for revision. There were no preexisting contractures to correct.

Possible mechanisms for our case could be either intraoperative hypotension, flexion positioning of the hip, re-operation, and patient comorbidities. It has been proven in literature that hypotension alone can be an

Figure 3: Left hip showing interval failure of acetabular component with vertical and superior migration of cup.

Figure 2: Left hip showing revision THA with acetabular screw placement with component in appropriate position (revision anteroposterior left hip radiograph).

Figure 4: Left hip showing revision THA with acetabular screw placement in appropriate position (second revision anteroposterior left hip).

external cause for acute thrombosis of an arterial graft [23, 24]. In our case, our mean arterial pressure remain between 60–87 mmHg which is in normal limits for THA [25]. As the previous two case reports have mentioned, prolonged flexion, internal rotation, adduction positioning of the hip intra-operative can lead to acute thrombosis. In our case, we utilized minimal flexion and external rotation during acetabular preparation and implantation. It is possible that the kinking of the graft during extreme flexion alone could be the precipitating factor for thrombosis. However in this case, the hip was never flexed to 90 degrees except after being relocated for intraoperative range of motion and stability testing.

Knowing the proposed mechanisms of vascular injury during THA, it seems possible to prevent these complications. Unfortunately, all that one can realistically achieve is to minimize these complications [6]. With the addition of this case report, approach does not appear to affect the formation of thrombosis on aortobifemoral bypass grafts [14]. Understanding possible complications is important for both the physician and patient. During the patient-physician discussion having an extensive discussion to present all the risks and benefits about the

Figure 6: CTA showing right iliac artery with contrast present after the bifurcation, but the left limb continues to show no contrast consistent with complete occlusion (CTA Occlusion 2 – Coronal).

Figure 5: CTA showing right iliac artery with contrast present after the bifurcation, but the left limb shows no contrast consistent with occlusion (CTA Occlusion 1 – Coronal).

procedure as possible. From a physician perspective, knowing that these complications can occur during any phase of the surgery is important. A majority of similar vascular complications occurred during the patients hospital stay, but one report had a patient come in 12 days after vascular injury with a necrotic limb [6]. In this case, preventing the loss of the limb can be attributed to having a patient aware of the possible complications, and multidisciplinary team-based action once the issue was identified.

In our case, one challenge to this study is the patient's comorbidities and life style choices. Patient had his initial THA performed for his bilateral avascular necrosis secondary to alcoholism. Consideration of patient's ability to comply with treatment protocol could have been evaluated prior to initial procedure. Patient, after the aortobifemoral bypass continued to use tobacco to the extent of two packs per day. Patient was unaware of hip precautions. Patient did not follow-up with vascular surgery one year after evaluation in 2010 as recommended. Total joint arthroplasty is listed as a safe, elective procedure but in some instances the

revision procedures are not exclusively elective. Although the treating physician did have cardiology and primary care physicians clear the patient for surgery prior to the procedure, no formal vascular workup was performed in the lower extremities after 2010. Considering the paucity of this injury, it is unlikely that any protocol would decrease the likelihood of this injury.

CONCLUSION

After review of the current literature, it appears that arterial complications after total hip arthroplasty (THA), although rare, continue to be present despite constant effort to prevent or decrease risk. With the catastrophic consequences of limb ischemia, it is important that we continue to educate patients of the risks, especially in the presence of peripheral vascular disease (PVD). Preventing vascular complications also requires, employing appropriate screening tests in patients with preexisting comorbidities, upholding appropriate surgical technique, and striving to be vigilant of this complication.

Author Contributions

Jacob Worsham – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Kathryn Bentley – Substantial contributions to conception and design, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Jared Cordon – Substantial contributions to conception and design, Acquisition of data, Revising it critically for important intellectual content, Final approval of the version to be published

Edmund Brinkis – Substantial contributions to conception and design, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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