



Case Report

Lower Limb Ischaemia Complicating Total Hip Arthroplasty 全髖關節置換手術併發下肢缺血的案例報告

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ABSTRACT

This article is about two patients having vascular injuries complicating total hip arthroplasty because of intraoperative indirect injuries. One patient had a delayed presentation of acute lower limb ischaemia, in which he required amputation of his left second toe because of ischaemic gangrene. The other patient had acute lower limb ischaemia leading to permanent muscle and nerve damage because of delayed recognition. Both patients had vascular interventions for the indirect vascular injuries. Preoperative workup for suspicious underlying peripheral vascular disease, intraoperative precautions, and perioperative period of vascular status monitoring are essential for prevention and early detection of such sinister events.

中文摘要

本文記錄兩個病人在進行全髖關節置換手術中引發的間接血管受創之案例。一名患者在手術後有延遲呈現下肢缺血的併發症，因而要切除左腳的第二隻缺血壞死的腳趾。另一名患者併發急性下肢缺血症狀，並因延誤而導致下肢肌肉和神經線永久損害。這兩名患有間接血管受創者均需要血管介入治療術處理。術前對懷疑潛在周邊血管病變的診斷檢查、手術中的預防措施，以及手術前後對血管狀況的監測是預防和及早發現這些災難性的併發症必需之手段。

Introduction

Vascular injuries in total hip arthroplasty are rare but very debilitating to the patients. It is important to recognise them as early as possible. Because of increasing use of acetabular screws in total hip arthroplasty in recent years, direct vascular injury is more common than indirect injury.^{1,2} Those patients with peripheral vascular disease (PVD) carry higher risk of indirect vascular injury, namely, occlusion, thrombosis, and embolisation of major arteries throughout the course of surgery. We report two cases of indirect vascular injuries in total hip arthroplasty with disastrous sequelae. After reviewing the literature, we discuss the proposed mechanisms and possible preventive measures.

Case 1

A 60-year-old man had a history of bilateral dysplastic hips with secondary osteoarthritis (Figure 1A) He complained of severe left

hip pain; otherwise he enjoyed a good past health. The physical examination showed no obvious leg-length discrepancy. The flexion range of the left hip was 0–90°, whereas the internal rotation and external rotation were markedly limited. Trendelenburg sign was positive on the left side.

Left hybrid total hip arthroplasty through the Hardinge approach was performed for this patient (Figure 1B) in February 2010. Perioperative low-molecular-weight heparin for the prophylaxis of deep vein thrombosis was given for 7 days. Posterior capsule release and anterior capsulectomy were performed. No perforation of the acetabular wall was noted intraoperatively. Acetabular screws were inserted in posterosuperior quadrant. The operation lasted for 2 hours and 40 minutes. It was uneventful with intraoperative blood loss of 800 mL.

On Day 11 postoperatively, he was complicated with acute coronary syndrome with an episode of low blood pressure and was treated with antiplatelet medications, including aspirin and clopidogrel (Plavix, Bristol-Myers Squibb/sanofi aventis, Paris, France). He had no symptoms of lower limb ischaemia or frank myocardial infarction. No specific documentation of the lower limb vascular status was noted. The patient was then discharged 2 weeks after the operation uneventfully. During the first follow-up at 6 weeks

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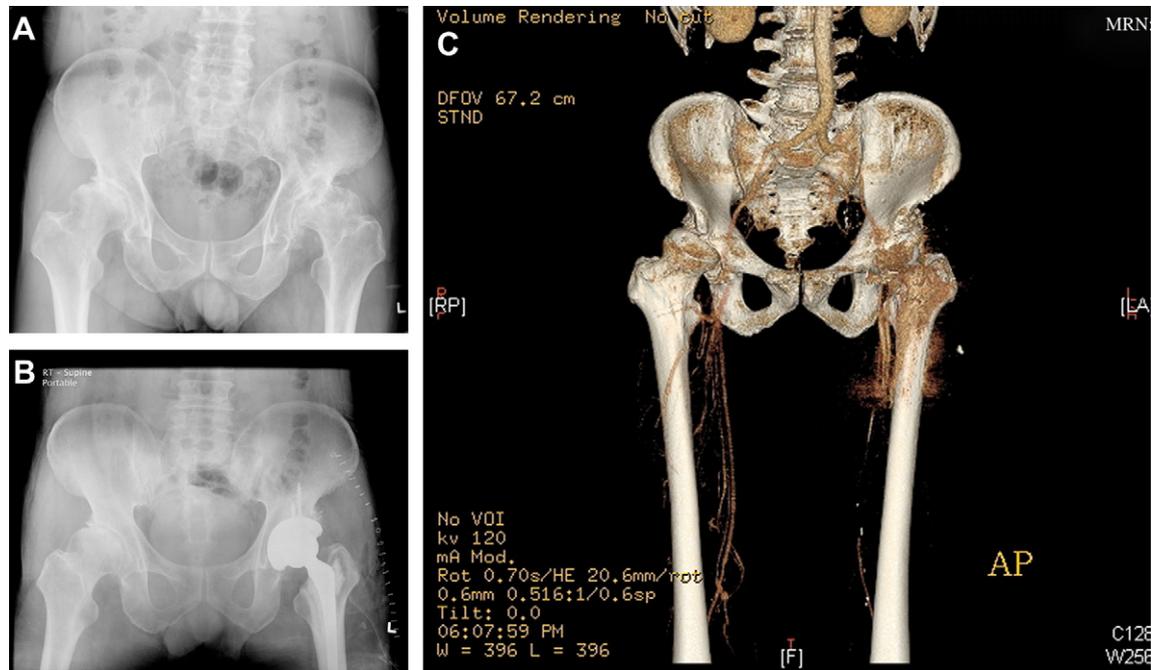


Figure 1. The radiographs show (A) bilateral dysplastic hips with secondary osteoarthritis and (B) the hips after left hybrid total hip arthroplasty was performed. (C) Computed tomography angiogram revealed a long segment of filling defect of the left superficial femoral artery down to the distal thigh level.

postoperatively, he complained of increasing left second-toe pain since few days after discharge. Physical examination revealed cyanotic change of his left second toe and the absent left lower limb pulses distal to the femoral artery. The other toes of his left foot looked normal, and the capillary refill was around 2 seconds. Major vessel occlusion or distal embolisation of the digital artery of the second toe was suspected.

Urgent computed tomography (CT) angiogram showed a long segment of filling defect of the left superficial femoral artery down to distal thigh level (Figure 1C). The diagnosis of severe stenosis of left superficial femoral artery was made. Echocardiogram revealed no cardiac mural thrombus. Percutaneous transluminal angioplasty without stenting for the left superficial femoral artery stenosis was performed by the interventional radiologists. The lower limb pulse was regained after the procedure. However, amputation of the left second toe was subsequently performed because of dry gangrene. Harris hip score increased from 58 (preoperative) to 93 at 1 year postoperatively.

Case 2

A 54-year-old woman complained of severe right hip pain. She had secondary osteoarthritis of right hip because of past septic arthritis. She also had diabetes mellitus, hypertension, and hyperlipidaemia. Physical examination showed 2-cm right femoral shortening. The flexion range of her right hip was 0–70° with very minimal internal and external rotation.

Cementless total hip arthroplasty (Figures 2A and 2B) was performed through posterior approach under general anaesthesia in June 2010. Perioperative low-molecular-weight heparin for the prophylaxis of deep vein thrombosis was given for 7 days. Posterior capsulectomy was done. No extensive soft tissue release was required. No acetabular wall perforation by the retractor was noted intraoperatively. Acetabular screws were placed at the posterosuperior quadrant. The leg length was equalised intraoperatively.

The operation lasted for 3 hours and 20 minutes. The intraoperative blood loss was only 700 mL, and the patient was haemodynamically stable.

She was given epidural analgesia for postoperative pain control. Six hours postoperatively, the patient was found to have low blood pressure, which was initially responsive to fluid challenge. Later on, her right lower extremity became cold and pale with right lower limb pulses being absent. Urgent CT angiogram was performed. Filling defect from right common femoral artery to whole superficial femoral artery was noted. Minimal collateral circulation was noted. The blood flow of deep femoral artery was also significantly diminished (Figure 2C). The diagnosis was acute arterial thrombosis. Emergent thrombectomy was performed by the vascular surgeons. Intraoperatively, there was long-segment thrombosis from the right common femoral artery down to popliteal artery. Distal run-off was absent in the right lower limb. Atherosclerotic plaque was found at the junction of common and superficial femoral arteries. Shortly after the re-establishment of right lower limb circulation, she was complicated with reperfusion syndrome and compartment syndrome of her right leg. Urgent right leg fasciotomy was performed.

The patient was stabilised later on, and secondary suturing of the fasciotomy wounds was done subsequently. Follow-up angiogram showed mild irregularity of the right common femoral artery without significant stenosis and the occluded right deep femoral artery (Figure 2D). Although the lower limb pulses were regained after the vascular operation, there was permanent neuromuscular damage of the right lower limb. There were decrease of right foot sensation and absence of right toe power. Her power of right ankle dorsiflexion and plantarflexion was only four of five according to Medical Research Council (MRC) grading. She needed to walk with a pair of elbow crutches on discharge 2 months postoperatively. She was last seen at 6 months after the total hip arthroplasty. She was able to walk unaided. The Harris hip score increased from 56 (preoperative) to 90 (postoperative).

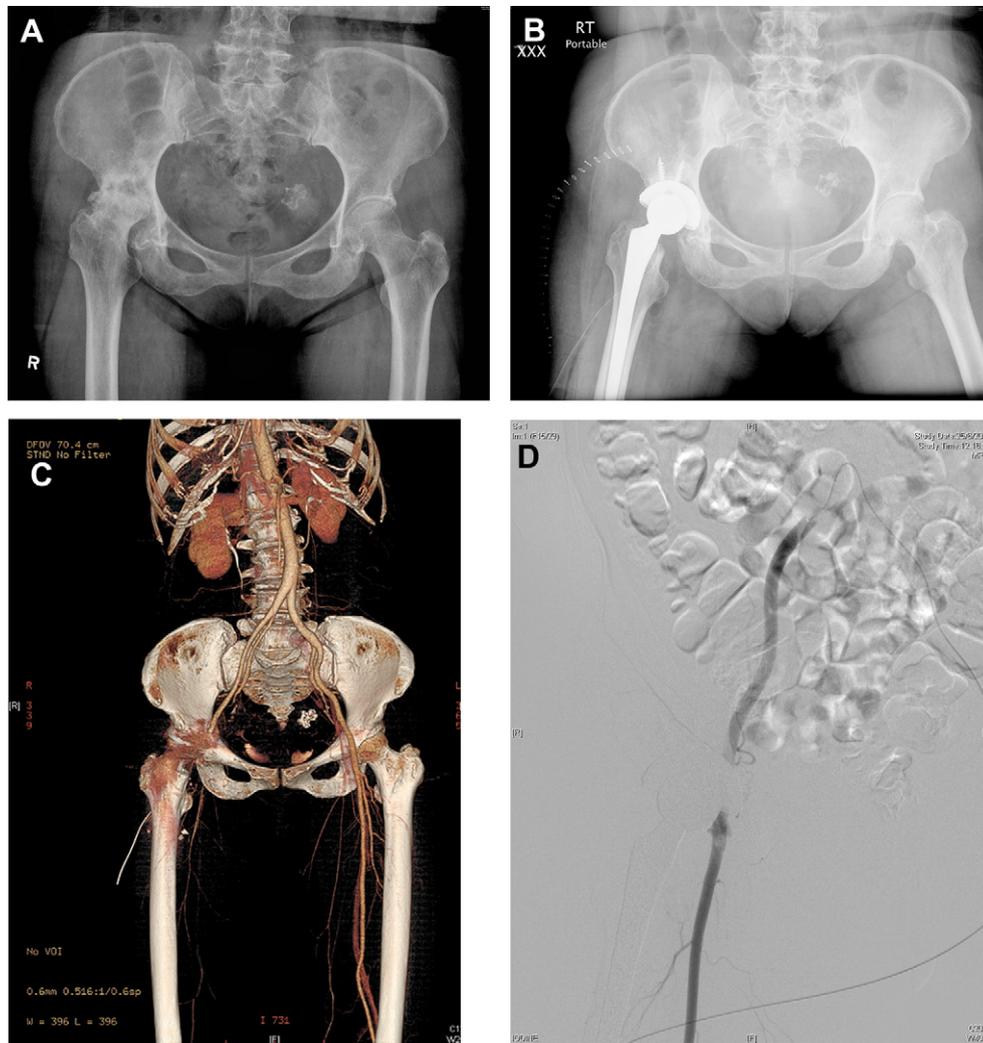


Figure 2. The radiographs show (A) secondary osteoarthritis of right hip from past septic arthritis and (B) the hip after cementless total hip arthroplasty was performed. (C) Computed tomography angiogram revealed filling defect of right superficial and common femoral arteries without good collateral circulation. (D) The angiogram showed no significant stenosis of the right superficial femoral artery but a significant stenosis of the occluded deep femoral artery after the thrombectomy.

Discussion

Vascular injuries in total hip replacement are uncommon, which occur only in about 0.2–0.3% of the cases,^{3,4} but it can be life or limb threatening. The pathogenesis includes thrombosis, embolism, lacerations, and formation of pseudoaneurysms and arteriovenous fistulae of the vessels. Direct vascular injuries are more common in total hip arthroplasty.¹ It can be the result of misplacement of retractors around the acetabulum, which can lead to the tear of the vessels. It can also occur as a result of insertion of supplemental screw fixation of the acetabular component.^{1,5} Indirect damage can result from stretching, forceful manipulation that causes vascular tear, and compression.⁶

Arterial obstruction can be caused by intrapelvic leakage of cement, injudicious drilling, positioning, manipulation, or retraction on the vessel during the operation. These can cause intimal and medial tear of the vessels that results in acute thrombosis or distal embolism. PVD is well known to be related to arterial thrombosis and embolism because atherosclerosis decreases the blood flow and increases the brittleness of the vessel. Hence, the luminal plaque will facilitate thrombosis after mild intimal and medial tear of vessel.^{2,7} Arterial thrombosis because of laceration of artery with

pre-existing atherosclerosis with traction on the limb had been reported.⁸

There are some surgical tips to decrease the risk of vascular injury in total hip arthroplasty. First, cementation of the acetabular side should be done with caution. It includes the liberal use of bone graft to fill defects and avoidance of excessive reaming in patients with protrusion of the acetabulum. It will reduce the risk of intrapelvic leakage of cement, which will cause thermal injury to the intrapelvic vessels, especially in revision surgery.^{4,8} Second, we must adopt the acetabular quadrant system described by Wasielewski et al⁵ in determining the site of acetabular screw fixation. Posterior-superior and posterior-inferior quadrants carry the least risk for neurovascular injuries. Third, unicortical drilling is safer than bicortical drilling in preparing the screw tracts.² Moreover, correct placement of the retractor anteriorly is crucial. The tip of the retractor should be placed directly on bone and should not pierce the psoas muscle, which was the only barrier between the acetabulum and the femoral vessels. Excessive retraction with a narrow-tipped Hoffman retractor (DePuy company, Indiana, Warsaw, USA) should be avoided as it may indent and damage the femoral vessels.⁶ Pre-existing peripheral vascular status should be documented and evaluated before the hip arthroplasty operation

even if the patients are relatively young as our second patient, especially with risk factors of PVD, such as hypercholesterolaemia, diabetes, and hypertension.

In our first patient, it is likely that mild intimal tear of the atherosclerotic femoral artery during positioning of the hip and retraction might have caused thrombosis of the vessel. Dislodgement of thrombus or plaque in stenotic femoral artery may cause distal embolisation of very small vessels in the second toe. The chronicity of this severe stenotic superficial femoral artery had been demonstrated by good collateral circulation shown in the CT angiogram, and therefore, the presentation was delayed.

In our second patient, PVD was undiagnosed preoperatively, but the CT angiogram showed some atherosclerotic plaques at the junction of common and superficial femoral arteries afterwards. The soft tissue scarring from old infective arthritis might increase the difficulties in surgical exposure. Inadvertently prolonged retraction for exposure and awkward positioning might damage these vulnerable vessels. The intimal tear of the vulnerable vessels resulted in acute thrombosis. Poor collateral circulation made the presentation drastic compared with that of the first patient.

Vascular insult could also occur during hip dislocation, surgical approach, retraction by a narrow-based Hoffman retractor at the site of anterior rim of acetabulum, and prolonged awkward positioning in 90° internally or externally rotated flexed hip. These might cause intimal tear, occlusion, and kinking of the vessels.⁹ In preparation of acetabulum, adequate soft tissue release and optimal hip position without excessive rotation and flexion are beneficial.

Indirect injury tends to be unrecognised in contrast to direct injury, in which pulsatile bleeding, sudden hypotension, and tachycardia would be noted intraoperatively.² Epidural analgesia and excessive pain medication will mask the pain symptom of acute

limb ischaemia as in our second patient. A routine objective post-operative assessment of the lower limb circulation status is advised to detect vascular injury earlier,⁷ including palpation of lower limb pulses and measurement of the ankle-brachial index.

Conclusion

The sequelae and risk of vascular insult in total hip replacement could be minimised by adequate preoperative vascular examination, various intraoperative precautions, and a routine post-operative surveillance of lower limb vascular status with early interventions.

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