



Case Report

Total hip revision arthroplasty of high-risk pelvic vascular injury associated with an endovascular approach: a case report[☆]



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ARTICLE INFO

Article history:

Received 10 March 2017

Accepted 11 April 2017

Available online 27 July 2018

Keywords:

Acetabulum

Bone screws

Hip prosthesis

Vascular system injuries

ABSTRACT

Vascular injury during a revision total hip revision arthroplasty surgery is an uncommon event; nonetheless, it is recognized as an intraoperative complication. Preoperative planning becomes imperative in such cases, especially when there is a conflict between the implanted material and the iliac vessels. Usually an ilioinguinal approach is used to identify the vascular structures at risk and isolate them from the prosthetic components, which increases the duration and morbidity of the procedure for the patient. The article describes a less invasive alternative approach to prevent intraoperative arterial injury. The patient was informed that the data related to her case would be submitted for publication and signed an informed consent form.

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Revisão de prótese total do quadril com alto risco de lesão vascular pélvica associada a abordagem endovascular: relato de caso

RESUMO

A lesão vascular durante cirurgia de revisão da artroplastia do quadril é um evento incomum, porém reconhecido como complicação perioperatória. O planejamento pré-operatório torna-se imperativo nesses casos, especialmente quando há conflito entre o material implantado e os vasos ilíacos. Usualmente faz-se uma abordagem com via de acesso ilioinguinal para identificar as estruturas vasculares em risco e isolá-las dos componentes protéticos, o que aumenta o tempo de duração e a morbidade do procedimento para o paciente. O artigo descreve uma abordagem opcional menos invasiva para prevenção de lesão arterial intraoperatória. A paciente foi informada

Palavras-chave:

Acetábulo

Parafusos ósseos

Prótese de quadril

Lesões do sistema vascular

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<https://doi.org/10.1016/j.rboe.2018.07.002>

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de que os dados relativos ao seu caso seriam submetidos a publicação e assinou um termo de consentimento livre e esclarecido.

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Introduction

Arterial and venous injuries are uncommon but devastating complications during orthopedic surgeries; not only do they lead to high morbidity and mortality in patients, but there is also a high index of lawsuits associated with these injuries.¹

The usual treatment of previously identified vascular injuries involves an extraperitoneal anterior pelvic approach or a large-vessels approach through laparotomy,² which adds a higher rate of postoperative complications and greater morbidity to the revision procedure.

Case report

A 79-year-old female patient was seen at this hip surgery facility in July 2016 due to severe pain in the right inguinal region and antalgic gait. She was diagnosed with osteonecrosis of the femoral head. In 1989, she had undergone decompression of the femoral head at another medical service and in 1997 she underwent total left hip arthroplasty for the same reason. In 2003, she underwent left total hip revision arthroplasty due to the early release of the femoral component with impacted graft, and in 2004 she underwent right total hip arthroplasty, also due to coxarthrosis secondary to avascular necrosis of the femoral head. All procedures were performed by the same surgeon.

At the time of the medical appointment, the imaging exams showed the presence of hybrid total hip arthroplasty on the right with femoral component loosening (which had receded and was in varus), acetabular component secured with three acetabular screws (two intrapelvic), and volumetric wear of

the polyethylene. The authors did not have access to the radiographs taken in the immediate postoperative period and outpatient follow-up, as the patient had been referred from another medical service. The contralateral revision arthroplasty presented a normal radiological aspect, with no signs of loosening (Fig. 1).

For preoperative planning, routine radiological and laboratory exams were requested, as well as pelvic angiotomography; the patient was also seen by a vascular surgeon, who performed an arterial and venous Doppler ultrasonography of the iliac vessels (Fig. 2A and B). Imaging showed an intimate relationship between one of the intrapelvic screws and the right external iliac artery, but no signs of vascular injury or extrinsic compression were observed in the pelvic vessels studied. The patient underwent an endovascular procedure (Fig. 2C and D) for introduction of a 9 mm × 100 mm Gore Viabhan endoprosthesis with heparin in the right distal external iliac artery through a right femoral puncture. After the procedure, double antiaggregation therapy (aspirin and clopidogrel) was maintained for four weeks. The antiplatelet agents were discontinued shortly after this period, followed by total right hip revision arthroplasty using the Kocher-Langenbeck approach. The acetabular component and acetabular screws were removed without any incidence; an acetabular revision was performed with the uncemented Zimmer Trilogy acetabular system. An extended femoral osteotomy was performed for removal of bone cement and revision, using the Zimmer ZMR distal fixation modular cone body (Fig. 3).

The patient was discharged two days after the surgical procedure; two months post-revision, she presented radiological consolidation of the osteotomy and partial weight-bearing on the lower limbs was authorized.

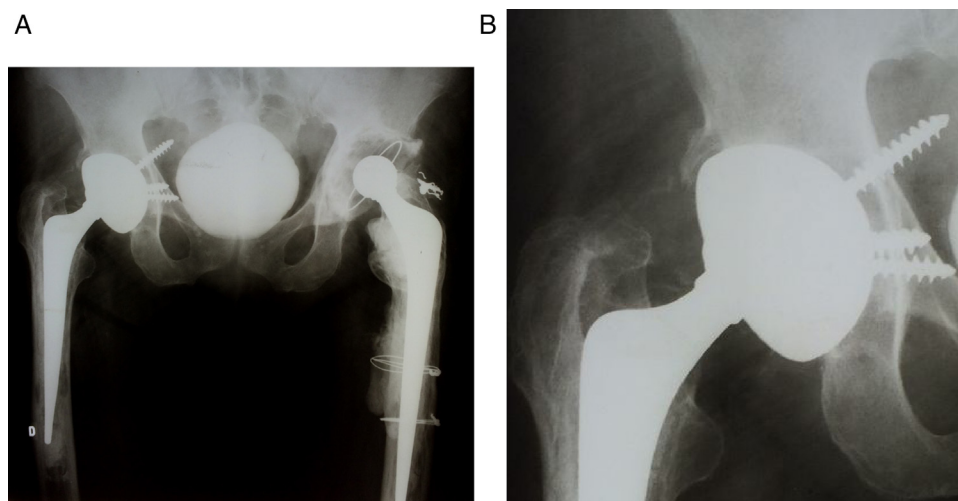


Fig. 1 – The patient's preoperative images. (A) Anteroposterior radiograph of the hip; (B) detail of the acetabulum.

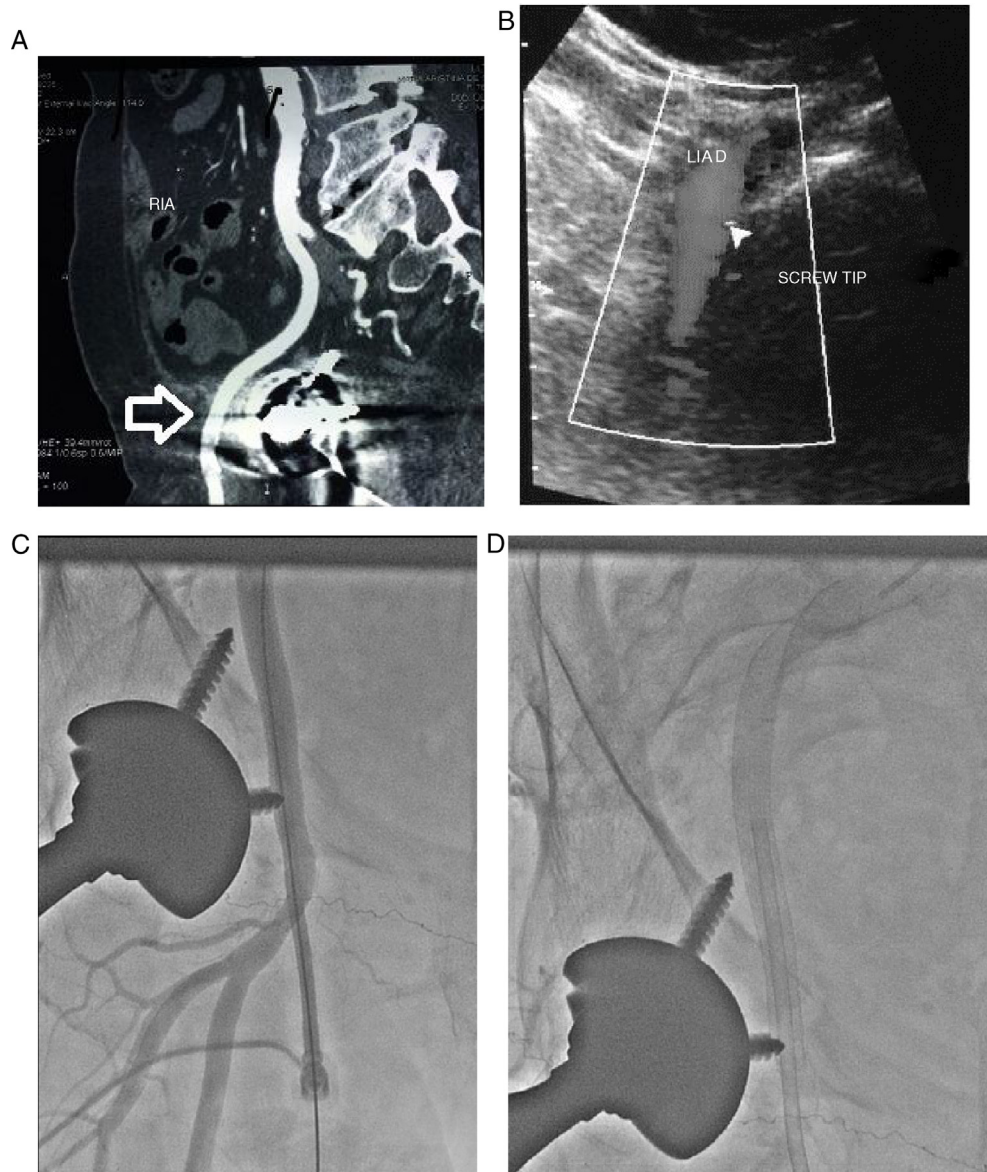


Fig. 2 – (A) Angio-tomography – the arrow indicates the relationship between the acetabular screw and the external iliac artery; (B) arterial Doppler ultrasonography of the same region; (C) preoperative arteriography; (D) control arteriography confirming the position of the endoprosthesis.

Follow-up ultrasound assessment of the vascular endoprosthesis demonstrated patency and absence of significant stenoses.

Discussion

Arterial and venous injuries are rare but worrisome complications of orthopedic surgeries. They can occur by direct perforation and hemorrhage; they can be diagnosed during the surgical procedure, requiring immediate intervention, or they may occur late through chronic friction between the implant and vessels, resulting in the formation of a pseudoaneurysm or late arterial damage, revealed by bleeding months later.³

Some of the risk factors for vascular injury in hip arthroplasty are revision surgery, pelvic migration of the acetabular component, female gender, left side, and periprosthetic infection during surgery.² The present case had three of the five risk factors and therefore was referred for additional diagnostic imaging exams. In addition to an appointment with a vascular surgeon, conventional arteriography and angiotomography are the exams of choice.⁴

In 1990, Wasielewski et al.⁵ described the four quadrants to safely position screws in the acetabular component (Fig. 4). The quadrants are delimited by a longitudinal line that unites the anterosuperior iliac spine to the center of the acetabulum. It divides the acetabular fossa into anterior and posterior halves. Another line is drawn in the center of the

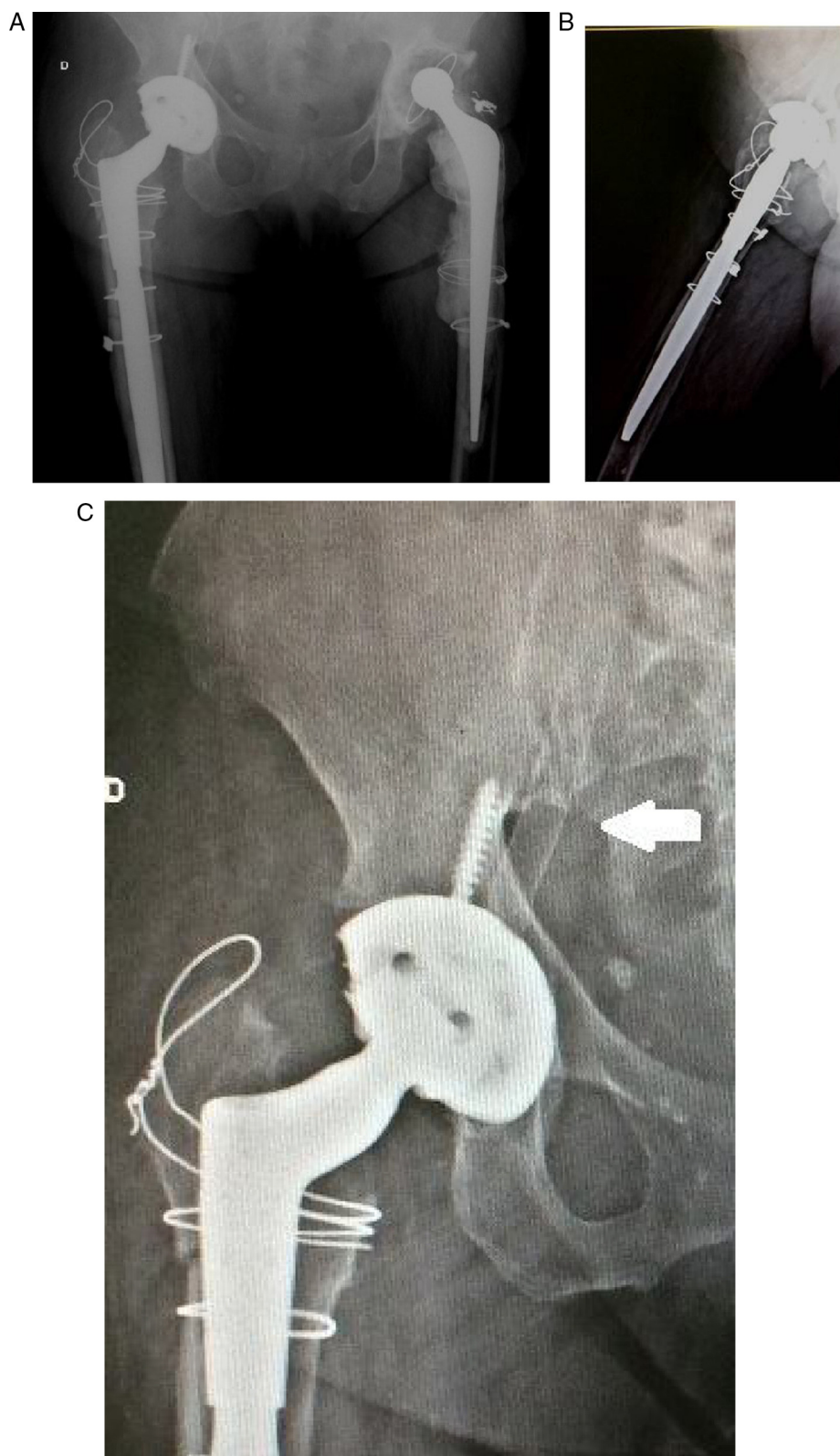


Fig. 3 – (A and B) Anteroposterior and lateral postoperative radiographs; (C) endoprosthesis (arrow).

acetabulum, perpendicularly to the first line, dividing the acetabulum, forming four quadrants. Cadaveric studies have shown that bone thickness is higher in the posterosuperior and posteroinferior quadrants; therefore, they provide greater

safety, both regarding better screw fixation and lower risk of vascular damage. The anterosuperior (known as the “death quadrant”) and the lower anteroinferior quadrant are at higher risk of such complications.^{5,6}

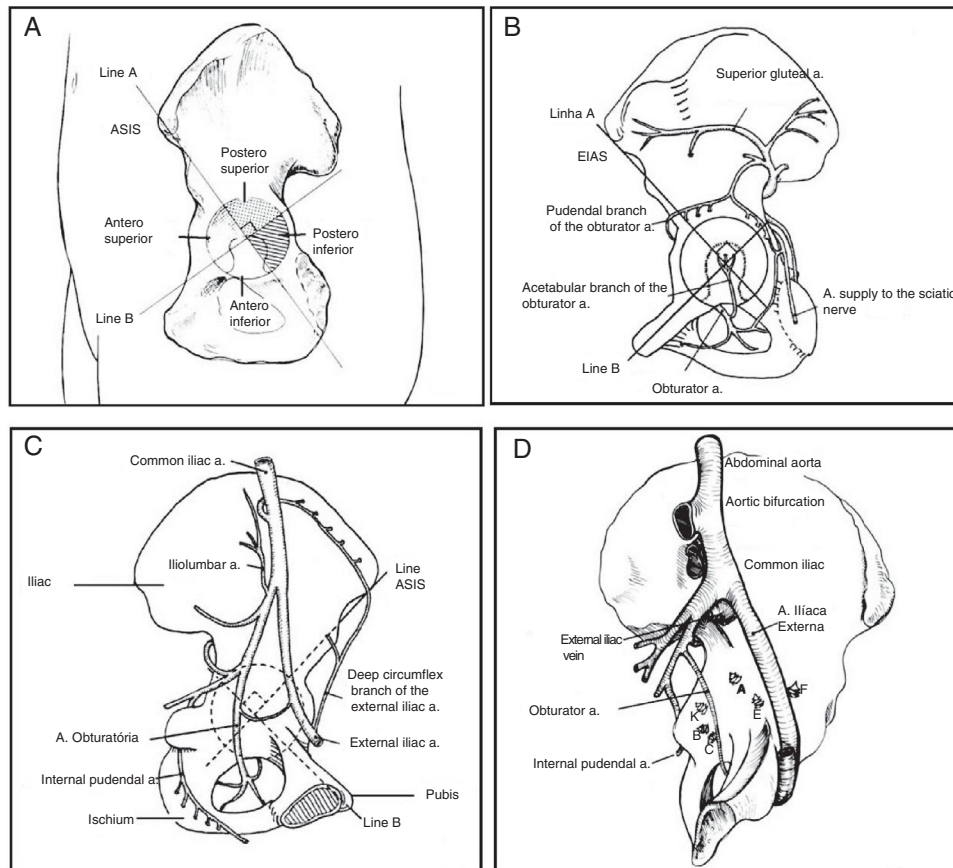


Fig. 4 – (A) Schematic view of Wasielewski's four acetabular quadrants; (B) major vessels; (C) relationship between pelvic bone structures and acetabular quadrants; (D) an illustration of excessively long screws and their relation to the iliac vessels. ASIS = anterior superior iliac spine. Translated from Wasielewski et al.⁵

The main vessels at risk during hip arthroplasty are close to or even within the pelvis. They include the external iliac, internal iliac, femoral, internal pudendal, and upper and lower gluteal arteries. These may be injured during retractions, perforations using drills or steel wires, acetabular reaming, or even during deep dissection; their rupture can cause severe acute bleeding and exsanguination within minutes. Previous reviews have defined thromboembolic events as the main etiologies of vascular injuries during hip arthroplasty, followed by laceration, pseudoaneurysm, and arteriovenous fistula. Another possibility is thrombotic occlusion of the iliac and/or femoral arteries, which leads to a risk of lower limb loss.⁷

Among the indirect mechanisms of injury, stretching, mechanical compression, and laceration are noteworthy. Direct mechanisms include excessive acetabular reaming or incorrect retractor positioning. The artery most commonly involved in vascular injuries during hip arthroplasty is the external iliac artery⁵; the most common mechanism of injury is a direct perforation.¹ The left side is more commonly involved than the right side, and a total mortality rate of 7% has been associated with this type of complication, as well as a 15% risk of radical lower extremity amputations and 4% risk of more selective amputations.⁸

The external iliac artery is more commonly injured than the external iliac vein. Retractors positioned too medially in the region proximal to the transverse acetabular ligament have been described as the main causes of injury. To minimize this risk, these instruments should be propped directly on the bone. Regarding the internal iliac vein, the risks are of injury caused by inadvertent excessive reaming and laceration due to protrusion of the acetabular component or poorly inserted acetabular screws. Wasielewski's anterior quadrants should be avoided during insertion.^{4,9} In the anteroinferior quadrant, there is the risk of thermal injury of the external iliac artery and vein due to extruded cement during acetabular cementation and its polymerization with heat release. To prevent this injury, it is important to adopt a proper cementing technique and to deliberately use bone grafting to fill defects in this quadrant.

Femoral vessels may be damaged by an abnormal positioning of retractors. It is important to avoid interposition of tissue between the retractor and the bone, especially the iliopsoas muscle; the surgeon must ensure that the retractor tip is propped on the bone. Acetabular component migration, cement extrusion, and anterior capsule dissection have also been described as causes of femoral artery and vein injury.

The inferior and superior gluteal arteries may be injured during screw fixation of the acetabular components or by the presence of fixed intraosseous retractors near the ischial notch. Proper drilling and palpation technique prior to this surgical step can reduce risks.

Albeit rare, obturator vessel injuries may occur through indirect contact with cement fragments or osteophytes, as well as through inadvertent positioning of the retractor in the superolateral corner of the obturator foramen.⁶

The classic approach described for lesions identified during the surgical procedure and for revision surgeries implies double surgical access and surgery in one or two stages. The first access is ilioinguinal, with a retroperitoneal approach to the iliac vessels and their isolation, or even clamping of the lesions for immediate or delayed repair. With this access, synthesis material, bone cement, or intra-pelvic acetabular components can also be isolated and removed. Subsequently, the surgeon's preferred access route is used for the revision surgery.

The literature presents several reports of successful surgical treatment of vascular injuries, but with high morbimortality, especially in cases of acute intraoperative bleeding.^{10,11}

The use of coated stents has been described in the endovascular treatment of perforation injuries¹²; and in thrombotic injuries through fibrinolysis and conventional stents.⁷

Nonetheless, the injuries described often affect the femoral region alone or together with external iliac artery injuries. The great mobility of the femoral region can lead to stent rupture; therefore, it is important to choose coated stents with greater flexibility, which allow a greater adaptation to hip movements. Nitinol alloy self-expanding stents appear to be more suitable for this purpose, with good patency in the medium-term.¹³

In the case described, the authors used the Viabhan[®] (Gore[®]) stent with heparin, which is made of a nitinol alloy and PTFE coating. Its use in the femoropopliteal segment, which is subjected to high shear forces, presents lower rates of restenosis and stent fracture than conventional stents.¹⁴

The close contact of the acetabular screw with the right external iliac artery, visualized in the duplex scan and by tomography, presented a high risk of vascular injury during surgery, which could cause high morbimortality. The authors decided to preoperatively implant a coated vascular prosthesis at the possible damage site. To date, they have found no reports of this preventive approach through the endovascular technique.

The analysis of preoperative images in cases of hip arthroplasty revision surgery appears to play an important role in the prevention of intraoperative vascular injuries. The preventive preoperative endovascular approach with the use of adequate material is an option in high-risk cases, due to the low morbimortality and its elective character.

Conflicts of interest

The authors declare no conflicts of interest.

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