CLINICAL REPORT

Common femoral artery intimal injury following total hip replacement. A case report and literature review

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Summary Vascular injuries diagnosed during the course of total hip arthroplasty (THA) implantations are rare. They must be constantly feared as they sometimes put at risk the vital and functional prognosis of the operated limb. We report the case of a common femoral artery injury diagnosed by arteriography within two days of THA replacement in the presence of atypical symptoms. The vascular damage was caused by an arterial lesion resulting from positioning a retractor on the anterior wall of the acetabulum. A literature review on the topic of vascular complications arising after THA made us aware of multiple possible mechanisms and clinical presentations relating to such complications while identifying specific risk factors in THA replacement cases. Acetabular revision constitutes a major risk situation. Most of these vascular complications may be better prevented or more efficiently treated by thorough preoperative assessment and careful postoperative monitoring.

Introduction

Acute arterial complications occurring after total hip arthroplasty (THA) are rare, with orthopaedic surgery teams not reporting more than a few isolated cases over a long time period [1–3]. According to Duparc [1], their low incidence must be considered an element of severity in itself as such vascular complications are not the first explanation given in difficult surgery cases. They remain serious because they influence the functional prognosis of the operated limb, and even put at risk patients’ vital prognosis. In the literature, we find different types of lesions with various types of mechanisms [1,2,4–6], and their diagnosis is often difficult considering that the symptoms are not very specific. We report a case of common femoral artery laceration during THA replacement.

Observation

Born in 1950, this female patient presented with congenital dysplasia of both hips in association with necrotic avascular remodelling changes. The right hip had been
operated on many times (greater trochanter lateralization osteotomy, THA, THA revision). This hip was asymptomatic, despite the presence of radiological signs of osteolysis. Mobility of the components was not obvious on repeated radiographic controls. The left hip had been operated on three times. A high valgus femoral osteotomy, directional de-rotation and deflexion with Chiari’s osteotomy had been performed in 1982 by the double simultaneous lateral and anterior approach of Smith-Petersen. This was followed by a left THA in 1995 using a Moore’s posterolateral approach for secondary coxarthrosis. The polyethylene cup was cemented in a Kerboull’s reinforcement acetabular device and the femoral head was made of zircon. Because of secondary functional degradation associated with polyethylene wear and femoral osteolysis, this prosthesis was revised in 2007 by the posterolateral route of Moore (Figs. 1 and 2).

To achieve good acetabulum exposure (made difficult by major periarticular fibrosis), the femur was reclined forward with an Hohmann retractor hooked on the deficient anterior acetabulum wall, which showed a severe loss of bony substance. The Kerboull’s device appeared stable and in a good position; it was preserved. The femoral stem was loosened and replaced by a new stem with an alumina head. The intervention thus comprised replacement of the polyethylene insert and the femoral implant with an alumina head.

In the immediate postoperative period, the patient did not manifest any vasculonervous problems. Three hours after the intervention, a sensory deficit occurred from dysesthesia of the left foot with paralysis of the long extensor muscles of the toes and long extensor muscle of the hallux. Twelve hours after surgery, the clinical picture was completed by a clear motor deficit of the anterior tibial muscle associated with a loss of strength of the triceps and posterior tibial muscle. During the first 12 hours, the posterior tibial pulses and left pedal were felt but more weakly than the right. There was no increase in volume of the hematoma on the thigh or in the scar. After 24 hours, recovery of the motor deficit of the anterior tibial muscle was apparent. After 48 hours, examination revealed a decrease in warmth of the left toes compared to the contralateral side. The peripheral distal pulses were thus not felt. Emergency arteriography showed a common left femoral artery tear of 4 cm, causing total obstruction (Figs. 3 and 4).

Exploration of the common femoral artery by the Scarpa approach allowed us to authenticate the 4 cm intimal tear, treated surgically by installation of a prothetic patch. Peroperatively, the anterior side of the cup was visibly in direct contact with the common femoral vascular package. In the immediate postoperative period, the distal peripheral pulses were symmetrical. The patient progressively recovered sensitivity and subnormal motricity. At one year recall, the hip was mobile and painless, but the distal pains persisted subsequent to the initial subacute ischemia that responded incompletely to medical treatment.
Beguin et al. [4] defined the vascular risk factors associated with prothetic hip surgery. Vascular complications in the course of prothetic hip surgery are extremely rare [1]. Different series in the literature have reported an average frequency of 0.2 to 0.3% [2,3,5,7,8]. Extremes varied from 0.08% [3]—for a single group of hip prostheses (this study at times included hip and knee prostheses)—to 0.67% [7]. These complications may be delayed, as in the case of pseudo-aneurysms and arteriovenous fistulas [6], or immediate: hemorrage (sometimes with compressive hematomas) and/or ischemia from arterial injury, traumatic arterial tearing or mobilisation of atheromatous plaque. Shoenfeld et al. [9] reported vascular lacerations in 18 patients in a review of 68 vascular trauma cases. Four isolated ruptures of the intima leading to thrombosis have been described in the literature: Jonsson et al. [10] observed intimal rupture and thrombosis after THA replacement. Nachbur et al. [5] reported two cases in a series of 15 arterial complications: intimal rupture and thrombosis of the superficial femoral artery or external iliac artery after THA and THA replacement. In a review of 14 vascular complications, Beguin et al. [4] reported one case of intimal rupture of the initial portion of the femoral artery complicated by thrombosis after THA by the posterolateral route, which comprised reconstruction of a dysplastic acetabulum with 3 cm lowering.

Risk factors for arterial lesions

Beguin et al. [4] defined the vascular risk factors associated with a more significant risk of vascular complications during THA. Except for vascular history (arteriopathy, bypass, alcohol and tobacco use) and bone anomalies (rheumatoid polyarthritis, Paget’s disease, osteoporosis, osteitis, corticotherapy, X-irradiation), anatomic abnormalities, such as acetabular dysplasia, congenital dislocation, acetabular protrusion [11] and acetabulum or pelvic fractures, constituted known risk factors. However, for them, acetabular revision remained the most serious situation. Muscle wasting and scar alteration could lead to anatomical changes [1]. Acetabular implantation could provoke vascular lesions, especially in case of local adherences. Sometimes difficult dislocation of the prothetic head may be at the origin of traction mechanisms not tolerated by the vessels. Reconstruction is also risky. According to Shoenfeld et al. [9], re-intervention for THA represents 39% of situations at risk. To Jonsson et al. [10], fibrosis and/or metallosis favor joining of the vessels and implants during prothetic unsealing. In parallel, Calligaro et al. [3] did not find the risk to be significantly higher in replacement surgery than in first-intention surgery in a series of 9,581 THA with 1,769 revisions (eight cases of acute arterial complications, seven after first-intention THA and 1 after revision), whereas they reported a rate of acute arterial complications six times higher in total knee prosthesis replacements than in THA replacements (0.36 versus 0.06). This may be explained by the low incidence of these complications. For the same reasons, it is less likely that feminine predominance and left hips among arthroplasties complicated by vascular attack, as reported by Bergqvist et al. [7], have real predictive value. Infection, a logical predisposing factor (local infiltration by inflammatory tissue with the disappearance of planes and spaces), has been proposed by many authors [10,12]. Thus, the patient that we are reporting was at high risk of vascular complications, given her medical history.

Causes of arterial lesions

Duparc [1] divided the lesional mechanisms into three groups:

- traumas of the elongation or vascular torsion type which may be produced during dislocation and reduction maneuvers;
- traumas from persistent pressure due usually to the tip of an Hohmann type retractor placed on the anterior acetabulum wall;
- and, finally, cutting or penetrating traumas are the lesional mechanisms of iliac vessels most frequently incriminated in acetabular revision: perforations of the acetabulum by a pin, during drilling or during the implantation of an acetabular screw, have been reported to be responsible for vascular lesions [4,5].

The dilaceration of vessels during reaming [13] and the vascular complications secondary to an exothermic reaction during cement polymerisation [14] have also been reported. Extraction of the acetabular anchoring cement plugs may finally be the cause of vascular wounds. Shoenfeld et al. [9], who studied 68 vascular complications of THA, found:

- 30 cases (44%) of incorporation of iliac vessels in cement;
- 12 cases (18%) related to a misplaced Hohmann retractor;
- seven cases (10%) secondary to excessive traction on the vessels;
- five cases (7%) deriving from intrapelvic migration of an acetabular component;
- two cases (3%) caused by excessive reaming;
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The presumed mechanism of all these arterial tears was excessive traction on the vessels during dislocation and reduction maneuvers with the prosthesis. In the report that we are presenting, several arguments favour a lesion caused by the tip of Hohmann retractor:

- a major bone defect of the anterior acetabulum wall;
- surgical difficulty in translating the femur forward to obtain satisfactory acetabulum exposure, requiring the placement of an Hohmann retractor on the anterior arm of Kerboull's acetabular device used previously;
- the absence of a muscular floor or of other interposing tissues between the femoral artery and the anterior edge of the cup, confirmed during replacement for vascular lesion repairs.

Diagnosis of arterial lesions

Different articles in the literature do not always mention the diagnostic strategy used. Nevertheless, we can differentiate two major situations: the first is that of an acute vascular accident occurring during the intervention or immediately postoperatively. The clinical picture does not leave any room for doubts in the diagnosis. In this case, the lesion is assessed during surgical replacement, which is undertaken urgently without previous paraclinical examination. At the most, we can conduct an echo-Doppler study to confirm the diagnosis before re-intervention, without postponing it. The other situation comprises complications occurring at a distance from the intervention and when patients present a more insidious clinical picture. In all these cases, the slightest doubt calls for exploration with urgent vascular opacification [1]. That is what makes the diagnosis certain and leads to rapid surgical replacement. In fact, the absence of peroperative wounds incriminating a local hematoma does not necessarily eliminate an eventual vascular complication: the case that we are presenting here fits in the second category of patients: the slow evolution several hours after the intervention favored an arterial tear; the initial intimal lesions spread further, detaching the arterial intima-media and ending in distal hypoperfusion. The clinical expression of such a subacute ischemic picture thus took the form of a distal neuromuscular deficit, which mimicked sciatic nerve attack during the early hours in the present case and erroneously delayed the hypothesis of a vascular problem.

Preoperative prevention methods

At first, at-risk patients have to be identified according to predefined criteria. In the preoperative stage, pelvic examination may allow us to evaluate the site and size of elements protruding in the lesser pelvis [15]. If the patient has an arthropathic or vascular surgery history, he or she should consult a vascular surgeon [11]. On the other hand, installation on the operating table and the set-up of supports would be prudent for patients with vascular bypass. Preoperative arterial Doppler on the table, with the patient installed, may help to verify the absence of pressure by the supports.

In risky situations, paraclinical assessment should comprise, besides the usual radiography, arteriography and phlebography or angioscan to define the anatomical rapport between the prothetic elements and vascular structures [1,11]. According to Gasiusas et al. [16], angio CT-scan is the reference examination in this context and should be complemented as needed by urinary or digestive opacification. The risk of intrapelvic complications whatever they may be is, in fact, important, notably in cases of collapse of the acetabular line [6]. This preoperative exploration, in collaboration with vascular surgeons, should allow us to precisely identify more suitable ways: needing or not needing retroperitoneal access to first control the iliac vessels, external and internal, to limit the risk of vascular injuries and their consequences. For actual access to the hip, we should discuss the advantage of an approach leading to dislocation of the hip prosthesis in flexion, for relaxed positioning of the common femoral axis. The mechanisms of traction during these dislocation or reduction maneuvers in scar tissue appear, in fact, to be particularly incriminated in arterial tearing [9]. Beguin et al. [4] have defined a precise decisional tree that permits codified management of THA revision. According to them, all acetabular revisions represent severity criteria (protrusion without a bone barrier, foreign intrapelvic bodies, intrapelvic cup dislocation) that should benefit from arteriography and preoperative phlebography. In case of calibre or vessel trajectory anomalies or false aneurysms, they recommended the retroperitoneal approach. In case of intrapelvic cup dislocation, the retroperitoneal approach should, according to them, be obligatory whatever the arteriography results. These recommendations were helpful in the case reported by Gasiusas et al. [16] since they justified the direct release of vessels before the ablation of acetabular material. They recalled different possible approaches to prevent various intrapelvic complications during THA ablation in protrusion situations: the Mears route reported by Stiehl et al. [17], which seems to be especially adapted to bone reconstruction attempts without allowing real control of noble organs, the transperitoneal route [18], the retroperitoneal route [15,19–21] and, finally, the combined route recommended simultaneously by Augereau et al. [22] and Petrera et al. [21]. According to Tazawa et al. [18], the choice between the retroperitoneal or transabdominal approach depends on iliopsoas muscle state: if it is intact, the retroperitoneal approach is possible. In contrast, with the components in contact with the peritoneum, laparotomy is preferred.

Conclusion

An arterial tear may translate into a picture of acute or subacute, atypical ischemia. The signs may be unclear because of progressive hypoperfusion, as in the case presented here. This instance of diagnosis obtained through close postoperative follow-up suggests to confirm the need for actively searching a vascular complication in presence of any unusual distal vascular compromise symptom following hip prosthesis surgery. This is even more true when there are other risk factors that should be have been preoperatively recognised. Finally, the analysis of each individual situation should determine if preoperative arteriovenous opacification is
necessary on one hand, eventually resulting in appropriate surgical conduct on the other hand: deliberate use or not of a retroperitoneal approach for iliac vessels primary control prior to the orthopaedic act.

References