Title

External iliac artery thrombosis following open reduction of acetabular fracture : a case report and literature review

Abstract

Background Postoperative thrombosis of the external iliac artery (EIA) following open reduction and internal fixation for acetabular fracture is extremely rare.

Purpose To report a patient with EIA thrombosis following open reduction and internal fixation using the modified ilioinguinal approach for acetabular fractures.

Study design This is a case report of a 69-year-old male with a left acetabular fracture who was treated surgically.

Methods A 69-year-old male presented with left hip pain after a 1.5-meter fall. Radiographs revealed left acetabular anterior wall and posterior hemitransverse fractures with dome impaction. Computed tomography (CT) showed atherosclerotic changes in many arteries. Open reduction and internal fixation were performed using the modified ilioinguinal approach. Adhesion around the external iliac vessels was severe, and the external iliac vein (EIV) ruptured during exposure. After EIV repair, anatomical reduction was achieved and the fracture was fixed using a reconstruction plate. Nine hours after surgery, the left lower limb showed acute ischemic symptoms. Contrast-enhanced CT indicated complete occlusion of the left EIA. The patient was immediately taken for a thrombectomy via EIA cut-down using a Fogarty catheter. Postoperatively, he had palpable dorsalis pedis and posterior tibial pulses; however, post-reperfusion compartment syndrome developed. Fasciotomy of the left leg was performed.

Result At the two-year and four-month follow-up, he was pain-free in his hip and leg. Although he was walking with a cane, activity was limited due to a mild foot drop.

Conclusions It is very important for surgeons to consider EIA thrombosis as a potential complication following open reduction and internal fixation. In this case, EIA thrombosis could be explained by preoperative atherosclerotic changes and intraoperative vascular handling procedures. Preoperative screening and management, and meticulous surgical procedures are necessary for patients with a high risk of thrombosis.

Keywords: external iliac artery, external iliac vein, acetabular fracture, occlusion, thrombosis, ilioinguinal approach

Introduction

The management of acetabular fractures is a major challenge for orthopedic trauma surgeons. Major vascular injuries after open reduction of an acetabular fracture are rare, but potentially life-threatening. To our knowledge, only five cases regarding postoperative external iliac artery (EIA) occlusion have been reported [1-5].

Herein, we report a case of postoperative thrombosis of the EIA following open reduction and internal fixation using the modified ilioinguinal approach for acetabular fractures, which was presumably caused by preoperative atherosclerotic changes and intraoperative vascular handling procedures. We also reviewed the pertinent literature about postoperative occlusion of the EIA for acetabular fractures, with a focus on the cause of these fractures.

Case report

A 69-year-old male presented with left hip pain after a 1.5-meter fall. His body weight was 54 kg and he was 170 cm tall. His medical history included intracranial hemorrhage, prostatectomy and radiation for prostate cancer, and left inguinal hernia surgery. There was no indication of diabetes or hyperlipidemia in his medical history. Neurovascular assessment of both legs was normal. Radiography and computed tomography (CT) revealed a left displaced acetabular anterior wall fracture and posterior hemitransverse fracture with dome impaction (Fig. 1), which was determined to be AO/OTA 62B3.1, according to the AO/Orthopaedic Trauma Association classification [6]. CT showed atherosclerotic changes in many

arteries. His left lower extremity was not placed in a skeletal traction device before surgery.

Four days after the initial accident, open reduction and internal fixation were performed using the modified ilioinguinal approach. Adhesion around the external iliac vessels was severe in the wide range, and the external iliac vein (EIV) ruptured during exposure. The EIV was repaired using the second window of the ilioinguinal approach by a cardiovascular surgeon. The EIA was compressed or retracted during repair of the EIV rupture. After this, these external iliac vessels were retracted using a Penrose drain to facilitate adequate visualization of the fracture site. Direct reduction of the dome impacted fragment and artificial bone grafting were performed using the modified Stoppa window. Anatomical reduction was achieved and the fracture was fixed using a reconstruction plate. At the time of closing, an arterial pulse of the leg was palpable.

Nine hours after the surgery, the left lower limb was pale and cool to the touch, compared to the right side. No pulses of the left popliteal and dorsal arteries of the foot could be palpated. Contrast-enhanced CT showed complete occlusion of the left EIA (Fig. 2). The patient was immediately taken for a thrombectomy via EIA cut-down with a Fogarty catheter. A long thrombus of the left leg was delivered out as a mass smoothly from the EIA (Fig. 3). Postoperatively, he had palpable dorsalis pedis and posterior tibial pulses; however, post-reperfusion compartment syndrome developed in the left lower leg. Fasciotomy of the left leg was performed. At the two-year and four-month follow-up, the patient did not have any pain in his hip and leg. He was walking with a cane, although his activity was limited due to a mild foot drop. The functional outcomes were assessed by the Matta score [7]; the score was 13,

indicating that the clinical grade was fair. Radiological outcomes, according to the Matta score [7], were also good (Fig. 4).

Discussion

The present case demonstrates postoperative EIA thrombosis following open reduction and internal fixation through the modified ilioinguinal approach for acetabular fractures. The cause of the EIA thrombosis was compression or retraction of EIA during astriction and repair for EIV rupture, which was associated with adhesion around the vessels due to past abdominal surgery; the cause of thrombosis in this case was different from previous cases.

There are many factors that may cause EIA thrombosis from the time of injury to the end of postoperative management in the clinical setting. These are divided into two groups, as follows: (1) uncorrectable factors such as past history, injury mechanism, and fracture type, and (2) preventable factors such as treatment strategy, perioperative management, and intraoperative procedure. To our knowledge, only five cases of postoperative EIA occlusion for acetabular fracture have been reported (Table 1) [1-5]. The present case was found to be the fourth case among cases with postoperative EIA thrombosis, based on our literature review. The fracture type included anterior column or anterior wall fracture in all cases. The cause of thrombosis was speculated as an inappropriate surgical procedure in two cases [1, 5] and atherosclerotic plaque rupture in two cases [2, 4]. In one case, the EIA was thrombosed at the time of injury, and the graft was placed before acetabular surgery; however, ischemic

symptoms mimicking EIA thrombosis due to EIA spasm occurred at the end of acetabular surgery [3].

Our study is interesting in that four out of five cases (80%) occurred on the left side. In other anatomical studies using CT, the external iliac vessels were located closer to the pelvis as they exited the pelvic cavity. In particular, the left side vessels were located closer to the pelvis than those of the right side around the acetabular dome, especially in older or female patients [8]. We believe that the left external iliac vessels were more susceptible to initial damage than those of the right side for anterior column or wall fracture in acetabular facture because of these anatomical conditions. In addition, surgeons must expose and retract these vessels more extensively during fracture reduction and fixation to expose fragments in the left side, especially for patients who have adhesion due to past abdominal surgery.

In the present case, we should have considered other treatment options, including conservative treatment or total hip arthroplasty for patients with a high risk of thrombosis or cases with a high-technical demand, which is due to past abdominal surgery and roof impaction. When open reduction and internal fixation is performed, we urge caution upon using the ilioinguinal approach after inguinal hernia surgery and the modified Stoppa approach after prostatectomy and radiation; we recommend selection of an alternative approach, such as the Pararectus approach [9], which allows adequate exposure of the anterior column. Intraoperative vascular injury or thrombosis occurred due to vascular handling procedures, such as aggressive retraction and extensive exposure around the vascular bundle, fracture manipulation, or malpositioned instruments [10]. Vascular bundles should be handled as gently as

possible via en bloc dissection with elastic slings [1]. Orthopedic surgeons should pay attention to close circular monitoring in patients, especially those with high risks of experiencing atherosclerotic changes.

In conclusion, occlusion of the EIA after surgery for an acetabular fracture is a rare complication that can be life-threatening. It is very important for surgeons to be aware of this potential complication. Preoperative screening and management, and meticulous surgical procedures are needed for patients with a high risk of thrombosis.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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Figure legends

Fig. 1 (a) Plain radiograph showing a left displaced acetabular anterior wall fracture with posterior hemitransverse fracture. (b) Coronal plane on computed tomography showing marginal impaction of the acetabular roof

Fig. 2 (a) Three-dimensional computed tomography (CT) angiogram reconstruction showing complete occlusion of the left external iliac artery. (b) Maximum intensity projection in CT angiography revealing atherosclerotic changes

Fig. 3 (a) Acute arterial thrombus removed with a Fogarty catheter. (b) The length of the thrombus, from the proximal end to the distal end, was approximately 61 cm

Fig. 4 At the two-year and four-month follow-up, plain radiography showed acceptable reduction and slight osteoarthritic changes of the hip