

# Transection of Common Iliac Arteries and Veins Bilaterally

## A Survival after Bilateral Temporary Arterial Shunts and a Unique Postoperative Complication

Eric J. Kuncir, Demetrios Demetriades<sup>1</sup>

### Abstract

This is an unusual case report of a victim of a single gunshot wound with transection of all four common iliac vessels. The patient developed preoperative cardiac arrest for which he underwent a successful resuscitative thoracotomy. The iliac veins were managed by ligation and the iliac arteries were stented as part of damage control. The patient developed delayed acute anuria due to ureteric obstruction secondary to bilateral infected false iliac artery aneurysms. Reoperation with ligation of the arteries and extra-anatomic axillofemoral and femorofemoral bypass was successful. The patient survived with weakness of the lower extremities.

### Key Words

Iliac vessels · Damage control · False aneurysms

Eur J Trauma 2004;30:191–4

DOI 10.1007/s00068-004-1361-5

### Introduction

We report a survival of a patient who sustained simultaneous penetrating injury with near complete transection of both common iliac arteries and veins. The patient required resuscitative thoracotomy and damage control with bilateral arterial shunts and abdominal packing. A unique postoperative complication occurred with acute anuria secondary to bilateral ureter compression from pseudoaneurysms from both grafts.

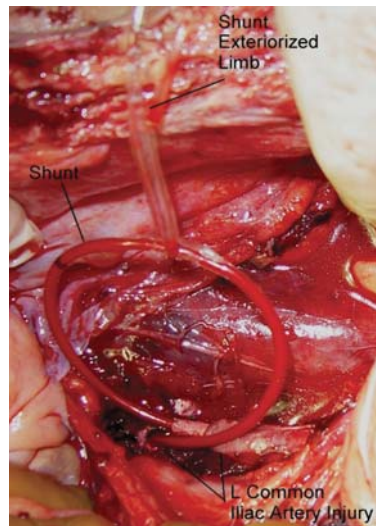
### Case Study

J.M., a 23-year-old Hispanic male, sustained a single gunshot wound to the left flank at about the mid axillary line at the level of the umbilicus. Los Angeles County Paramedics responded quickly to the scene, and the patient was unresponsive and had no obtainable vital signs during transport. The patient arrived in the trauma room at LAC + USC 7 min later. Primary survey revealed agonal respirations, a faintly palpable carotid pulse, and Glasgow Coma Score of 4. There was no visible active bleeding from a single wound to the left flank. The patient was intubated by rapid sequence induction and was taken directly to the operating room (OR) without any investigation. He lost pulses during transport and a resuscitative left thoracotomy simultaneous with a midline laparotomy were performed in the OR 15 min after initial arrival to the hospital. The aorta was cross-clamped and open cardiac massage and defibrillation were successful in reestablishing cardiac function after about 5 min. The laparotomy revealed massive hemoperitoneum with active bleeding from the pelvis. Both common iliac arteries and veins were nearly completely transected. Proximal and distal control of bleeding common iliac arteries was quickly obtained. Three bowel enterotomies were primarily repaired using single-layer technique. Because of persistent shock and acidosis, damage control was instituted and with the aortic cross-clamp removed, both iliac arteries were shunted and both common iliac veins ligated (Figure 1). A straight uncuffed shunt was placed across the right common iliac artery defect and a Pruitt-Inahara shunt was utilized on the left side with the external limb

<sup>1</sup>Division of Trauma and Surgical Critical Care, University of Southern California, Los Angeles, CA, USA.

Received: August 6, 2003; accepted: October 13, 2003.

**Figure 1.** Temporary shunt with with external limb. This limb can be used for postoperative irrigation.



brought outside of the abdominal wall through a separate stab wound. The pelvis was packed and the abdomen was closed using vacuum-pack technique. At the end of the operation, the temperature was 33 °C, pH 6.97, and the hemoglobin was 4 g/dl despite transfusion of eleven units of blood. The estimated blood loss was 6 l. Prophylactic fasciotomies were not performed due to concerns about coagulopathy and venous stasis and because the compartments were soft.

The patient was resuscitated, rewarmed and coagulopathy was corrected in the SICU. The left-sided shunt was infused with a small amount of heparinized saline periodically to maintain patency. 7 h after completion of the first operation, the patient was returned to the OR following correction of acidosis, hypothermia, and coagulopathy. Packs were removed, the shunts were found to be patent, and there was no limb ischemia. Distal flow was restored using a 6-mm PTFE interposition graft on each side. Calf compartments were firm and bilateral four-compartment fasciotomies were performed. The muscles were viable, and there was no evidence of ischemic damage. The pelvis was again packed and the abdomen closed with the vacuum-pack technique.

Postoperatively, bilateral anterior and posterior thigh fasciotomies were required early the next day because of apparent compartment syndrome. The patient was treated with mannitol and bicarbonate drip because of elevated creatine phosphokinase (CPK) levels (peak of 47,000). Abdominal fascial closure was done without any tension on hospital day (HD) 4 and the treatment for rhabdomyolysis was discontinued on HD 7. No renal dysfunction occurred.

On HD 8, the patient developed signs of necrotizing fasciitis of the abdomen and the leg muscles looked infected, so he was returned to the OR for debridement of the abdominal wall fascia and muscles. Leg and abdominal wounds grew out *Pseudomonas* and dilute Dakins dressings were instituted. Subsequently, the patient manifested early signs of adult respiratory distress syndrome (ARDS) and required a brief stint on a high-frequency percussive ventilator which quickly reversed its course and the patient was returned to standard ventilator support 4 days later. A tracheostomy was performed on HD 13.

By HD 22, the patient was tolerating tube feeds, was talking and had just begun bedside physical therapy, when a significant amount of self-limited bleeding was noted from the right edge of the open abdominal wound. Temperature spike and rapid onset of anuria prompted a noncontrast abdominal pelvic CT scan which demonstrated large bilateral retroperitoneal hematomas arising from the iliac artery grafts (Figure 2). The diagnosis of infected grafts was made and the patient was returned to the OR. Due to the difficult abdominal exploration, the iliac vessels were accessed by medial rotation of the mass of matted bowel loops and colon, bilaterally. Active bleeding from both grafts was encountered. Both grafts were removed and the iliac arteries were ligated. Right axillofemoral bypass and right-to-left femorofemoral PTFE grafts were placed. The feet remained warm with good distal Doppler pulses postoperatively. The urine output was restored within minutes of the hematoma evacuation. Long-term antibiotic coverage with linezolid was instituted.

10 days later, the left femoral graft was infected with methicillin-resistant *Staphylococcus aureus* (MRSA) and the wound was opened. Despite exposed graft, local dressings and systemic antibiotics were successful and no graft removal was necessary. Subsequently, the patient developed a low-output small bowel fistula which was controlled with bowel rest and TPN. The vacuum-pack system was applied to the open abdomen and the six extremity fasciotomy wounds which were all later skin-grafted. The patient slowly improved and is currently receiving rehabilitation.

### Discussion

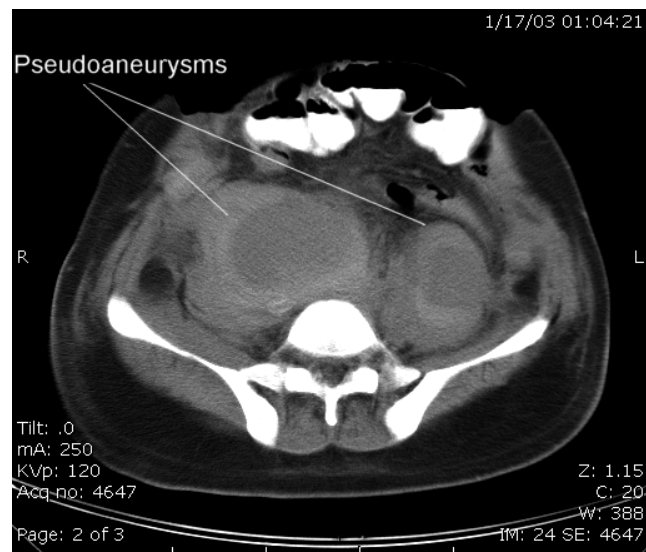
Several reports in literature clearly outline predictors of outcome and operative management strategies for injury to the iliac arteries [1–6]. First and foremost, all authors agree that the increased incidence of iliac artery

injury seen at urban centers is the direct result of improved prehospital care and transport [2]. Once in the hospital, survival is dependent on a number of factors including early suspicion of vascular injury, rapid vascular control and damage control procedures [3, 6]. Absence of retroperitoneal tamponade, shock and difficult operative exposure and vascular control contribute to the high death rate [3, 5, 6].

Ryan et al. [3], in a 1982 series of 114 iliac artery injuries, stated that the majority of patients (82%) were hypotensive on arrival. Moreover, 94% had abdominal tenderness and distension on presentation and 76% had the triad of hypotension, positive abdominal exam and entrance wound below the umbilicus [3]. Degiannis et al. [5], in a smaller 1996 series out of South Africa, substantiated the findings of the study by Ryan et al. Our patient was therefore accurately predicted to have a vascular injury based on these findings and was appropriately taken rapidly to the OR without confirmatory tests or X-rays.

Our patient went into cardiac arrest shortly before operation which prompted thoracotomy resuscitation. Nearly all deaths in several series occur in patients who are either hypotensive, arrive without a blood pressure or do not respond to initial fluid resuscitation [2, 3]. In the series by Burch et al. [4] on 358 penetrating iliac injuries, there was only one survivor out of the 41 patients that either required ER or OR thoracotomy.

In critically ill, hypothermic and coagulopathic patients, temporary intraluminal shunt with semielective reconstruction of the artery at a later stage should be considered. In our case, employment of bilateral shunts as an adjunct to damage control surgery allowed the initial operation to be terminated quickly enabling rewarming and replacement of coagulation factors to occur in the intensive care unit. Once resuscitated, the patient was returned to the OR. Ligation of the iliac arteries is not an acceptable option because of the high incidence of limb loss or severe reperfusion complications, if a subsequent attempt at revascularization is made [7]. The only previously reported case of intraabdominal temporary shunting in conjunction with damage control surgery was of the superior mesenteric artery (SMA) [8]. Reilly et al. [8] utilized a Javid shunt which maintained patency for 36 h allowing delayed repair of a Fullen zone II SMA injury. Porter et al. [9] reported the use of a shunt of the common femoral artery that maintained patency for 16 h following damage control surgery. Heparinization was not used in



**Figure 2.** CT without contrast shows two large pseudoaneurysms in pelvis.

either report and, in fact, it may not be necessary. A recent animal study in pigs found that 13 of 16 common iliac artery shunts remained patent without heparinization for 24 h [10]. Significantly, seven of eight shunts remained patent for that period in a group of animals in shock, in which the shunt was placed 1 h after induction of limb ischemia [10]. We chose to use small amounts of heparin locally to avoid systemic bleeding, however, both the heparinized and the unheparinized shunts remained patent for the 7 h required for the SICU phase of the damage control procedure.

Postoperative complications with iliac artery repair are usually attributed to associated injuries and, not as frequently, to the type of vascular repair used [1–5]. Injury to the small bowel and colon are most frequently reported followed by bladder and ureter injuries and, less commonly, other major vascular injuries [3]. Contamination, therefore, is a foremost concern with regard to the choice of arterial repair undertaken if primary repair cannot be achieved. Specifically, in a case of gross contamination, Burch et al. [4] advocated primary arterial ligation and extra-anatomic bypass. They performed six extra-anatomic bypasses with poor results, including three deaths, three amputations, three compartment syndromes, and two graft thromboses. Despite this recommendation, Burch et al. [4] chose to employ PTFE in five cases with associated colon injury and in twelve additional iliac arterial repairs. Interestingly, out of the 13 survivors of this group of which four

were survivors with a colon injury, none developed acute graft infection when PTFE was utilized [4].

More recently, Cushman et al. [11] reported use of three PTFE interposition grafts to address 37 iliac artery injuries, and none became infected. Yet, Degiannis et al. [5] reported one case of perigraft infection with a PTFE interposition graft out of the twelve cases (17%) that they used it. When primary repair cannot be achieved, selection of PTFE is therefore justifiable even in most cases with small bowel or colon injury.

Options for surgical treatment of iliac vein injury are limited to suture repair, ligation or PTFE interposition graft. The large series by Burch et al. [4] included 192 iliac venous injuries of which only one PTFE reconstruction was done. Hence, PTFE is rarely utilized [4]. Moreover, repair of complex iliac venous injuries resulting in severe stenosis may lead to thrombosis and, possibly, pulmonary embolism [7]. In most cases of severe iliac venous injury, ligation of the vein is preferable to repair, and in most patients this results in transient leg edema which responds to elevation and elastic bandage wrapping [7]. In our case, bilateral vein ligation may have contributed to massive extremity edema seen the day after revascularization necessitating thigh fasciotomies.

This case required removal of the graft as a result of infection and bleeding. In general, delayed bleeding a few days after the initial procedure is an ominous sign, if it occurs along with other signs of infection [7]. In our case, the manifestation of this was unique in that the patient became anuric as a result of large bilateral pelvic hematomas which presumably were compressing the ureters.

The reported overall mortality for patients with iliac vessel injury ranges from 30% to 50% for arterial injury and 25% to 40% for venous injury [7]. For isolated injuries the mortality is about 20% for arterial injury and 10% for venous injury [7]. Bilateral iliac injuries and combined arteriovenous injury had twice the mortality rate than for unilateral injury in the series by Burch et al. [4]. Feliciano et al. [12] reported the successful management of a bilateral external iliac artery injury resulting from a single missile in 1986. To our knowledge, our case represents the only survivor of simultaneous bilateral iliac artery and venous injury reported in the literature. Furthermore, it describes the first successful utilization of temporary common iliac arterial shunts for damage control. Local heparinization did not appear to make a difference in shunt patency

over a 7-h period. It is unknown, however, if the infusion itself contributed to eventual graft infection which led to an unusual complication of anuria secondary to pelvic hematoma. Our review of the literature found no reported case of obstructive acute anuria due to false aneurysm. Indeed, this event was an interesting setback to the patient who otherwise appeared to be on the road to full recovery. It should be added to the differential diagnosis of diminished urine output in SICU patients following pelvic vascular surgery.

## References

1. Mattox K, Rea J, Coyne E, et al. Penetrating injuries to the iliac arteries. *Am J Surg* 1978;136:663-7.
2. Millikan J, Moore E, Van Way C, et al. Vascular trauma in the groin: contrast between iliac and femoral injuries. *Am J Surg* 1981;142:695-8.
3. Ryan W, Snyder W, Bell T, et al. Penetrating injuries to the iliac vessels: early recognition and management. *Am J Surg* 1982;144:642-5.
4. Burch J, Richardson R, Martin R, et al. Penetrating iliac vascular injuries: recent experience with 233 consecutive patients. *J Trauma* 1990;30:1450-9.
5. Degiannis E, Velmahos G, Levy R, et al. Penetrating injuries to the iliac arteries: a South African experience. *Surgery* 1996;119:146-50.
6. Asensio J, Petrone P, Roldan G, et al. Analysis of 185 iliac vessel injuries. Risk factors and predictors of outcome. *Arch Surg* 2004;in press.
7. Demetriades D, Murray J, Asensio J. Iliac vessel injuries. In: Rich R, Mattox KL, Hirshberg A, eds. *Vascular trauma*. Philadelphia: Saunders, 2004;in press.
8. Reilly PM, Rotondo MF, Carpenter JP, et al. Temporary vascular continuity during damage control: intraluminal shunting for proximal superior mesenteric artery injury. *J Trauma* 1995;39:757-60.
9. Porter JM, Ivatury RR, Nassoura E. Extending the horizons of "damage control" in unstable trauma patients beyond the abdomen and gastrointestinal tract. *J Trauma* 1997;42:559-61.
10. Dawson DL, Putnam AT, Light JT, et al. Temporary arterial shunts to maintain limb perfusion after arterial injury: an animal study. *J Trauma* 1999;47:64-71.
11. Cushman J, Feliciano D, et al. Iliac vessel injury: operative physiology related to outcome. *J Trauma* 1997;42:1033-40.
12. Feliciano D, Coselli J, Bitondo C. Bilateral external iliac artery injury from a single missile. *J Cardiovasc Surg* 1986;27:46-8.

## Address for Correspondence

Demetrios Demetriades, MD  
 Director, Division of Trauma and Surgical Critical Care  
 LAC + USC Trauma Center  
 Rm 1105  
 1200 North State Str  
 Los Angeles, CA 90033  
 USA  
 Phone (+1/323) 226-7761, Fax -6238  
 e-mail: demetria@usc.edu