

Robert J. Schoderbek · Todd C. Battaglia
Erik R. Dorf · David M. Kahler

Traumatic hemipelvectomy: case report and literature review

Received: 24 November 2004 / Published online: 21 April 2005
© Springer-Verlag 2005

Abstract Traumatic hemipelvectomy is a rare but devastating injury involving complete disruption of the hemipelvis from the pubic symphysis to the sacroiliac joints and often results in death. We present an interesting case of traumatic hemipelvectomy caused by a previously undescribed mechanism of injury in which judicious angiography and aggressive surgical treatment contributed to patient survival.

Keywords Amputation · Hemipelvectomy · Multiple trauma · Pelvis

Introduction

Complete dislocation of the hemipelvis, known as traumatic hemipelvectomy, is a catastrophic injury resulting from violent blunt trauma and presents as complete disruption of the hemipelvis from the pubic symphysis to the sacroiliac joints. This injury has been rarely reported over the past 50 years [5, 6, 11, 15]. Historically, this injury pattern has usually resulted in death, but during the past two decades, improvements in initial trauma response, surgical treatment, and medical management have resulted in increased chances of survival [1, 6, 7, 8, 12, 16]. We describe an interesting case of traumatic hemipelvectomy caused by a previously undescribed mechanism of injury. In this instance, emergent angiography and embolization of the iliac vessels, followed by semi-emergent hemipelvectomy, contributed to patient survival.

Case report

C.H., a 20-year-old female college student, was an unrestrained driver involved in a high-speed motor vehicle accident in which her car struck a tree. She was partially ejected through the vehicle windshield, but her right lower extremity remained entrapped beneath the dashboard. A below-knee amputation of the right leg was required at the accident scene to extricate the patient. She was initially taken to an outlying facility where evaluation revealed hypotension, tachycardia, and multiple injuries, including a severely displaced right hemipelvis (OTA 61-C1) (Fig. 1), facial fractures, a nondisplaced transverse left acetabular fracture (OTA 62-B1.2), left femur fracture (OTA 32-A2.2), left tibia fracture (OTA 42-A2.3), and extensive crush injury of the left foot. Although the right pelvis and leg had no major lacerations or open wounds proximal to the level of the amputation, the extremity was cold, mottled, insensate below the proximal thigh, and lacked a detectable femoral pulse. Past medical history was significant only for obesity (patient height was 170 cm, weight was 98 kg). She was taken to the operating room for emergent proximal right above-knee guillotine amputation, Chopart amputation of the left foot, external fixation of the pelvis, and external fixation of the left femur and tibia. Postoperative radiographs revealed minimal improvement in pelvic reduction after application of the fixator (Fig. 2).

Postoperatively, the patient continued to require transfusions to maintain adequate blood pressure and was taken emergently to the angiography suite. Arteriogram demonstrated transection of the right external and internal iliac vessels (Fig. 3), for which coil embolization was performed (Fig. 4). Per report, the patient's blood pressure subsequently stabilized, and she was transferred to our trauma center for further management. Abdominal and pelvic CT demonstrated—in addition to the severe bony injury—large amounts of

R. J. Schoderbek · T. C. Battaglia (✉)
E. R. Dorf · D. M. Kahler
Department of Orthopaedic Surgery,
University of Virginia Health Sciences Center,
Box 800159, Charlottesville, VA 22908, USA
E-mail: tcb9n@virginia.edu
Tel.: +1-434-9240000
Fax: +1-434-2430242

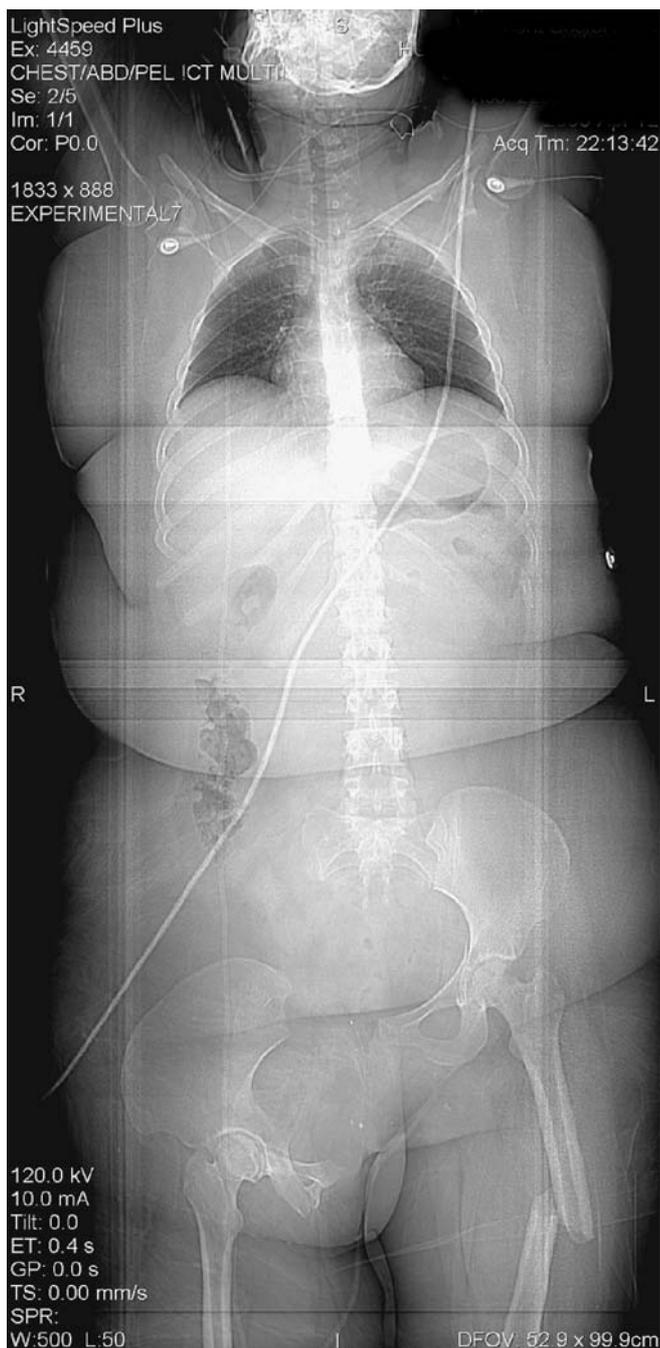


Fig. 1 Scout image from initial CT scan demonstrating grossly displaced right hemipelvis, as well as left acetabular and femur fractures. Also note significant patient obesity

hematoma in the right pelvis but no intra-abdominal injury and apparently intact bladder, rectum, and vagina.

Upon arrival at our institution, she was directly admitted to the surgical intensive care unit but was immediately unstable despite aggressive fluid resuscitation and continued transfusions. Repeat angiography was performed and showed occlusion of the right external and internal iliac arteries with thrombus in the common iliac artery, but continued leakage from multiple iliac branches. It was decided to completely



Fig. 2 Postoperative image after attempted reduction of the hemipelvis and placement of an external fixator

embolize the right common iliac artery, after which the patient became hemodynamically stable. Per our hospital's trauma protocol, and in anticipation of multiple future surgical procedures precluding consistent use of anticoagulants, a temporary inferior vena cava filter for pulmonary embolism prophylaxis was also placed at this time.

The patient returned to the operating suite 6 days later for débridement of her ischemic right thigh, which had demarcated along the groin crease anteriorly and mid-buttock posteriorly. After consultation with the trauma and plastic surgery teams, hemipelvectomy was not performed at this time point due to concern that, given the patient's obesity and the size of the resultant

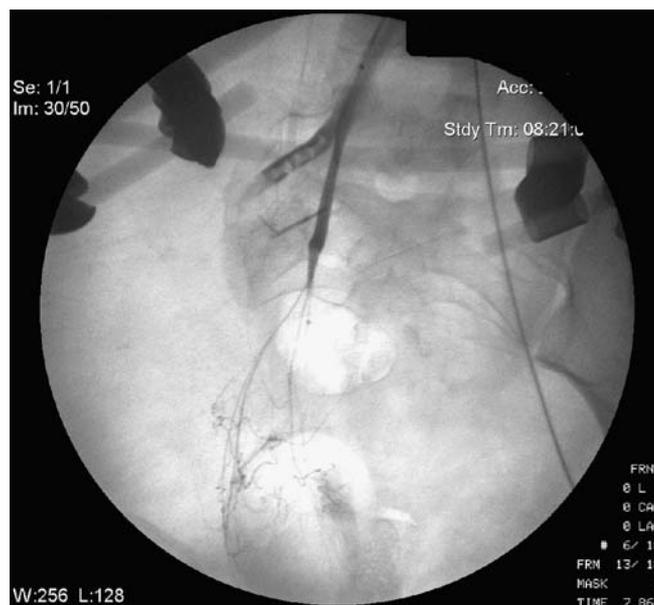


Fig. 3 Angiographic image demonstrating complete transection of internal and external iliac arteries

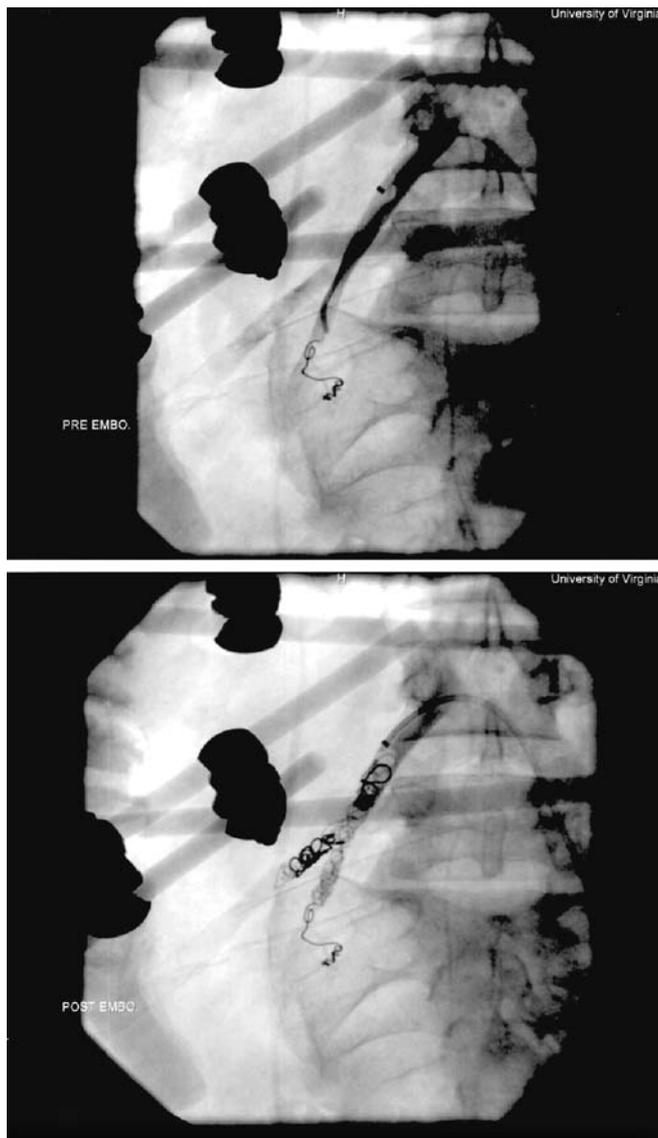


Fig. 4 Angiographic images during coil embolization of right common iliac artery bifurcation and internal and external iliac vessels

defect, containment of her abdominal contents would be exceedingly difficult. Accordingly, a high amputation through the femoral neck was performed along with open reduction and internal fixation of her right pubic symphysis and sacroiliac joint (Fig. 5). At the time of surgery, the right hemipelvis was noted to be freely mobile, with complete avulsion of all supporting musculature, including the pelvic floor and abdominal muscles. Unfortunately, the patient developed systemic infection with continued necrosis of her right groin wound and was returned to the operating room 3 days later for wide débridement of the right groin. The right hemipelvis was noted to be avascular and necrotic, a hemipelvectomy was performed (Fig. 6), and a closed suction/drainage system [Vacuum Assisted Closure Therapy (VAC), Kinetic Concepts, San Antonio, TX, USA] was placed for temporary wound management.

Placement of tracheostomy and gastrostomy tubes as well as a diverting colostomy to prevent fecal contamination of the pelvic wound were also performed.

Multiple further débridements and wound VAC changes for the pelvic wound were required over the next 3 weeks, in addition to retrograde intramedullary nailing of the left femur and left below-knee amputation. The transverse acetabular fracture was treated conservatively. Wound VAC treatment was continued for approximately 2 months, after which daily wet-to-dry dressing treatments were performed for more than 1 year to achieve wound closure. Extensive involvement of the psychiatry, nutrition, chronic pain, and therapy services was also required during hospitalization. Ultimately, the patient remained in the hospital for 110 days, after which she was discharged to home. At last follow-up, nearly 15 months after injury, she remained wheelchair bound but was in the process of prosthetic fitting for the left below-knee amputation. She suffers persistent bilateral phantom pain and requires narcotic and nonopioid pain medicines for pain control.

Discussion

Traumatic hemipelvectomy typically occurs secondary to motor vehicle accidents, especially those in which an individual riding a motorcycle or bicycle is sideswiped by an oncoming vehicle. When impact occurs, the pubic symphysis of the involved extremity is disrupted, and as deformation continues, disruption of the remaining pelvic supporting structures continues posteriorly to and through the sacroiliac joint. Wade and Macksood first described this mechanism of injury in 1965, which accounts for greater than 40% of traumatic hemipelvectomies [14]. This may be reflected in the fact that two-thirds of injuries involve the left side, often related to collision with oncoming cars or objects [1]. Direct avulsion of the limb after entanglement in heavy machinery (e.g., winches, combines, and roller belts) is the next most common mechanism of injury [1, 6, 13]. Finally, massive crush injury disrupting the entire hemipelvis has been described [1]. In this patient, however, the torso and left hemipelvis were presumably avulsed away from the fixed right lower extremity, which was entrapped under the dashboard as the victim was ejected through the vehicle windshield.

Regardless of mechanism, the injury involves separation of both the sacroiliac joint and pubic symphysis, vascular injuries to the iliac and femoral systems, peripheral nervous system injury, and varying levels of surrounding muscle and soft-tissue damage. Anatomically and functionally, this injury represents a traumatic amputation, but in more than 50% of cases, the limb is still attached to the victim [1, 8, 16]. These patients will present with a pulseless and insensate extremity [7]. Only approximately 65 survivors of this injury have been reported in the literature [11, 12]. The average age of survivors is 21 years (range 3–34 years), an indicator of



Fig. 5 Postoperative radiograph after open reduction and plating of the right sacroiliac joint and symphyseal pinning. The symphysis was pinned, rather than plated, to avoid further surgical exposure pending wound demarcation. Note loss of fixation of the anterior ring



Fig. 6 Radiographs after completion of the hemipelvectomy

the physiologic reserve required to survive this type of injury [3, 8, 10, 12]. Most survivors are male; this is only the tenth reported case of a female survivor [4, 10, 12]. Over the past 20 years, there has been an increase in the number of reported survivors, likely a result of improved emergency transportation methods and trauma service resuscitation, but overall survivorship remains poor. Accurate assessments of incidence and survival are difficult because most patients quickly succumb to massive blood loss and do not reach the hospital [10, 11, 12].

Successful treatment of these patients requires an aggressive resuscitative protocol. Uncontrollable hemorrhage may result from both osseous and soft-tissue injury as well as vascular avulsion, although vasoconstriction and retraction of the iliac vessels may prevent immediate exsanguinations [8, 13]. Arteriography or formal operative exploration may be required emergently, prior to additional trauma work-up, which should

include radiographs of the chest and pelvis; CT of the head, chest, abdomen, and pelvis; retrograde urethrogram with cystogram; intravenous pyelogram; and rectal examination.

Associated injuries include colorectal injuries (60%), genitourinary injuries (85%), and other orthopedic injuries [2, 4, 6, 7, 8]. Rectal injuries should be repaired appropriately, although proximal diverting colostomy to the contralateral side is recommended to prevent wound contamination even in the absence of rectal injury. In retrospect, the colostomy in our patient might have been performed earlier to control risks of fecal contamination more appropriately. Genitourinary injuries, most common in the prostatic and membranous urethra, should be treated with catheterization to stent the urethra, a supraumbilical diverting catheter, and secondary reconstruction at a later date. The decision to complete the traumatic hemipelvectomy can be difficult, but despite historical recommendations, most authors now agree that aggressive attempts at limb salvage are futile in most cases [7, 8, 11, 12, 13, 14, 16]. Commonly, completion of the hemipelvectomy is emergently mandated by uncontrollable hemorrhage or the presence of an ischemic lower extremity with complete loss of neurological function [1]. In this case, although hemorrhage was ultimately controlled via angiographic embolization, the level of vascular disruption led to a nonviable extremity. Most recent studies, including the largest existing series of traumatic hemipelvectomies, recommend early completion of the hemipelvectomy, which may allow a lower complication rate [11]. In fact, in that series, 75% of patients (3 of 4) in whom limb salvage was attempted died, and the fourth patient ultimately required completion of the amputation. In this case, given the extent of vascular and soft-tissue injury, initial management with angiography and attempted reconstruction were likely overly optimistic, and earlier completion of the hemipelvectomy may have simplified the patient's hospital course. Similarly, the primary external fixation was also probably unnecessary, as no improvement in reduction was achieved.

Sepsis is the most common life-threatening complication during hospitalization [1, 12]. Inadequate débridement of soft tissue, failure to perform a diverting colostomy, and inadequate urinary diversion are primary sources of contamination. The amount of nonviable tissue is often grossly underestimated, especially in the retroperitoneal muscles, iliopsoas, quadratus lumborum, and long muscles of the back. Gram-negative meningitis from ascending infection along the lumbosacral nerve roots has also been described [13, 14]. At initial débridement, it is exceedingly difficult to determine the full extent of devitalized soft tissue; repeat wound explorations and débridements are mandatory until delayed primary or secondary closure is possible. Closed wound-suction systems are a useful adjunct in these patients, who require multiple débridements and long-term evaluation of tissue viability. Split-thickness skin grafts, distant myocutaneous free flaps,

and rotational rectus abdominus or latissimus muscle flaps may also be necessary to provide effective coverage; local gluteal and thigh flaps are rarely possible due to tissue destruction.

Numerous other medical complications are also commonly seen. Coagulopathy, respiratory distress syndrome, abdominal wall necrosis, osteomyelitis, pulmonary embolism, gastrointestinal or urinary fistula, fecal or urinary incontinence, impotence, and neurogenic bladder have all been reported frequently in these patients [1, 8, 16]. In addition, the psychological and emotional impact of this overwhelming injury cannot be underestimated. Psychiatric, rehabilitative, and pain service evaluations should be initiated early in the hospital course. Phantom pain, narcotic dependence, and depression are common [5, 7, 9]. Because of the typical age of survivors of this injury, however, the potential for successful rehabilitation and independent activity is surprisingly good; nearly 90% of survivors may eventually ambulate with crutches or a prosthesis [1, 8]. Interestingly, in our patient who suffered both traumatic hemipelvectomy and a contralateral below-knee amputation, phantom pain was reported as much more severe in the former. Nevertheless, despite her massive injuries and significant complications, the patient's physical and psychological recovery has been impressive, and she has made plans to return to school. In this case, appropriate initial resuscitation, control of hemorrhage using angiography, and vigilant surgical management contributed to her survival and recovery from this rare injury.

Acknowledgements None of the authors of this paper have any relationship, financial or personal, with any company or individuals mentioned. All experiments and treatments reported comply with the current laws of the country in which they were performed.

References

1. Beal SL, Blaisdell FW (1989) Traumatic hemipelvectomy: a catastrophic injury. *J Trauma* 29:1346–1351
2. Chappel R, Herregods P, Gevaert M, Mortier G (1986) Traumatic hemipelvectomy, case report. *Acta Belg Med Phys* 9:79–83
3. Cho KJ, Kang YJ, Ahn J, Yoo TW (1999) Traumatic hemipelvectomy before body image has developed. *Yonsei Med J* 40:80–83
4. Danisi FJ, Stromberg BV (1985) Traumatic hemipelvectomy. *Plast Reconstr Surg* 76:945–947
5. Johansson H, Olerud S (1971) Traumatic hemipelvectomy in a ten-year-old boy. *J Bone Joint Surg Am* 53:170–172
6. Klasen HJ, Ten Duis HJ (1989) Traumatic hemipelvectomy. *J Bone Joint Surg Br* 71:291–295
7. Lawless MW, Laughlin RT, Wright DG, Lemmon GW, Rigano WC (1997) Massive pelvic injuries treated with amputations: case reports and literature review. *J Trauma* 42:1169–1175
8. Lipkowitz G, Phillips T, Coren C, Spero C, Glassberg K, Tolete-Velcek F (1985) Hemipelvectomy, a lifesaving operation in severe open pelvic injury in childhood. *J Trauma* 25:823–827
9. Meester GL, Myerley WH (1975) Traumatic hemipelvectomy: case report and literature review. *J Trauma* 15:541–545
10. Moore WM, Brown JJ, Haynes JL, Viamontes L (1987) Traumatic hemipelvectomy. *J Trauma* 27:570–572
11. Pohlemann T, Paul C, Ganssle A, Regel G, Tscherne H (1996) Traumatic hemipelvectomy. Experiences with 11 cases (in German). *Unfallchirurg* 99:304–312
12. Reiger H, Dietl KH (1998) Traumatic hemipelvectomy: an update. *J Trauma* 45:422–426
13. Rodriguez-Morales G, Phillips T, Conn AK, Cox EF (1983) Traumatic hemipelvectomy: reports of two survivors and review. *J Trauma* 23:615–620
14. Wade FV, Macksood WA (1965) Traumatic hemipelvectomy: a report of two cases with rectal involvement. *J Trauma* 5:554–562
15. Wand JS (1990) Traumatic hemipelvectomy without visceral injury. *J Bone Joint Surg Br* 72:327–328
16. Weiss WM, Egan MC (1994) Traumatic hemipelvectomy: a survivable injury. *Mil Med* 159:164–166