CHAPTER 5

PELVIC FRACTURES AND CRUSH INJURIES OF THE BLADDER

GU Tract Structure	Ch 2 Kidney	Ch 3 Ureter	Ch 4,5 Bladder	Ch 6,7,8,11 Urethra	Ch 8,9 Scrotum Testis	Ch 8,9 Spermatic Cord	Ch 8,10 Penis
No. Patients With Injury to Structure	132	36	72	83	199	14	128
% of Total GU Injuries	19.1	5.2	10.4	12.0	32.8	2.0	18.5

GU: genitourinary

INTRODUCTION AND WOUND ANALYSIS

Working at US Army Hospital, Camp Zama, Japan, we authors (JNW and JWW) saw casualties of the Vietnam War whose initial management had been in Vietnam. Some had penetrating wounds and others had crush injuries. We managed 15 patients of the latter type who had fractures of the bony pelvis with associated bladder injuries. Five of these patients had coexisting injuries of the membranous urethra, and their treatment, clinical course, and outcome are discussed in detail in Chapter 6, Blunt Pelvic Trauma With Posterior Urethral Disruption. For statistical purposes, however, these 5 patients are included in this chapter.

TABLE 5-1
ETIOLOGY OF CRUSH INJURIES OF THE PELVIS WITH ASSOCIATED BLADDER INJURIES

Etiology	No. Patients*
Vehicular Trauma	8
Fall from APC	2
Jeep accident	3
Motorcycle	1
Struck by truck	2
Crushed by Howitzer	1
Helicopter Crash	1
Struck by Falling Rock	1
Fall From Tower	1
Unknown Cause	3

*N = 15
APC: armored personnel carrier

The causes of these blunt/crush/shearing pelvic bladder injuries are found in Table 5-1. Vehicular accidents of various types accounted for the majority of these injuries. One patient was injured in a helicopter crash, and 1 was crushed by a howitzer. Our records did not reflect the cause of injury in 3 patients.

All 15 patients had fractures of the bony pelvis and bladder injuries

(Table 5-2). In addition to their bladder injuries, 5 patients had rupture of the membranous urethra (discussed in Chapter 6, Blunt Pelvic Trauma With Posterior Urethral Disruption) and 3 had soft-tissue scrotal perineal injuries. Of the 15 patients, data were retrievable from the records of 11; these 11 had significant other injuries not associated with the genitourinary tract (Table 5-3). Ten patients had injuries to up to 4 other organ systems. Four patients had colon injuries, with serosal tears being the most common. One patient had avulsion of the rectum and anus. Extremity soft-tissue and bony injuries occurred in 9 patients, 3 of whom had involvement of both upper and lower extremities. Two patients with pelvic fractures had dislocation of the hips requiring open reduction.

TABLE 5-2
PELVIC FRACTURES AND GENITOURINARY INJURIES

Injury	No. Patients*
Bony Pelvis	15
GU Tract	
Bladder	15
Urethra	5
Scrotal perineal	3

*N = 15
GU: genitourinary

TABLE 5-3
ASSOCIATED MAJOR ORGAN INJURIES

Organ or Body Part	No. Patients*
Abdomen–Pelvis	8
Liver	1
Spleen	1
Colon	4
Rectum	1
Anus	1
Chest	1
Fracture Transverse Process	2
Extremity	9
Upper only	3
Lower only	3
Both	3

*N = 11; patients may have had injuries to 1 or more major organs

Blunt injuries to the bladder are typically classified as contusions (most bladder injuries) and ruptures: either extraperitoneal, intraperitoneal, or a combination. Such information is important in making treatment decisions and, later, evaluating the results of therapy; and is key to the management of tubes, drains, and complications.[1–10] Unfortunately, such details of the bladder injuries were only present in the records of 4 of the 15 patients: intraperitoneal and extraperitoneal bladder rupture, 1 each; and 2 with bladder contusions, both of whom recovered without problems. The exact locus of bladder injury was not described in the records of 11 patients.

The initial primary treatment of the 10 patients with pelvic fractures and bladder injuries without membranous urethral injury is presented in Table 5-4. All patients had pelvic exploration and debridement and Penrose perivesical pelvic drains and various forms of bladder drainage. Bladder lacerations and ruptures were debrided and sutured with absorbable suture. The 2 bladder contusions were drained with a Foley catheter only, whereas many patients had both suprapubic cystotomy and Foley catheter bladder drainage.

TABLE 5-4
PRIMARY TREATMENT OF PELVIC–BLADDER CRUSH INJURIES (WITHOUT URETHRAL INJURY)

Primary Treatment	No. Patients*	
Pelvic Exploration	10	
Debridement and Primary Repair of Bladder	8	
Debridement of Pelvis	10	
Pelvic-Perivesical Penrose Drains	10	
Bladder Draining	10	
Suprapubic tube and Foley urethral catheter		5
Suprapubic tube only		1
Foley catheter only		4

*N = 10

In general, this group of 10 patients was free of significant complications in Japan, although 4 were evacuated to the continental United States with either a suprapubic or a Foley catheter but free of pelvic drains. One patient developed massive inguinal bleeding 17 days after the injury, which required evacuating the hematoma and packing his wound. Most of these patients were on the Orthopedic Service and seen by the urologist in consultation. Pelvic abscess, sepsis, and catheter complications with urethritis, stricture, and so forth were not appreciated in this group of patients. This is in contrast to those with pelvic crush injuries involving the bladder and urethra (see Chapter 6, Blunt Pelvic Trauma With Posterior Urethral Disruption), all of whom had a high rate of complications; many of this latter group required transfer to the Urology Service for prolonged treatment.

DISCUSSION

Associated Injuries

About 10% to 15% of pelvic fractures have associated genitourinary injury, usually either a ruptured bladder or partial or complete transection of the membranous urethra, whereas most patients with bladder injuries (83%–100%) have an associated pelvic fracture.[11] Pelvic fractures often are associated with considerable pelvic bleeding, resulting in distortion and displacement of the bladder. Frequently, bladder contusion is present even though perforation may not have occurred.

Clinical Findings

Most patients with significant blunt bladder injuries have gross hematuria, although microhematuria is uncommonly seen and is more often associated with bladder contusion.[9] After blunt trauma, lower abdominal pain, tenderness, and bruising are often found in patients with bladder injury.

Patient Evaluation

Urological evaluation of these patients ordinarily consists of a retrograde urethrogram if urethral transection is suspected (blood at the urethral meatus,

the patient is unable to void, or both). If resistance is met when the passage of the Foley catheter is attempted, retrograde urethrography should be accomplished (see Chapter 6, Blunt Pelvic Trauma With Posterior Urethral Disruption, for technique). If a catheter can be passed into the bladder retrograde, cystography with plain abdominal X-ray imaging and with full drainage films are virtually 100% accurate and definitively diagnosing significant bladder injury in large series.[9]

The technique of retrograde cystography involves gravity filling of the bladder with 350 mL of a 30% iodine intravenous contrast agent, and obtaining full and then completely empty bladder X-rays.[9] We believe that the presence of gross hematuria or a "surgical abdomen" following a crush injury of the pelvis mandates surgical exploration even though bladder rupture may not be demonstrable.[1–10] Many of these patients have multiple injuries that demand immediate resuscitation and surgery. Excessive blood loss may occur externally or internally; injuries to other organ systems are often present and require immediate attention, which often preclude the finite pretreatment diagnosis of bladder injury. Bladder and other lower urinary tract injuries can be diagnosed and treated at open surgery.

Initial Treatment (in Vietnam)

Bladder rupture may be intraperitoneal (Figure 5-1) or extraperitoneal (Figure 5-2). With increased filling, not only is the bladder more vulnerable to rapidly rising intraperitoneal pressure but it also typically tends to rupture along the peritoneal surface at the dome, presumably the region of least resistance. Classically, the treatment of intraperitoneal bladder rup-

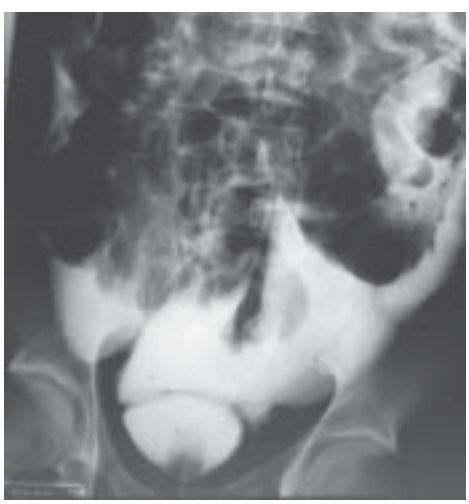

Fig. 5-1. The cystogram shows a crush injury with intraperitoneal extravasation of urine from the ruptured bladder.

Fig. 5-2. The cystogram shows a crush injury with extraperitoneal extravasation of urine from the ruptured bladder.

ture is surgical exploration, with primary bladder repair consisting of 2 layers of absorbable suture and insertion of a suprapubic tube along with perivesical pelvic drains. In patients with extraperitoneal bladder rupture who undergo laparotomy, careful inspection for associated injuries to the lower urinary tract is mandatory to avoid missing urethral disruption, prostate and bladder neck injury, or unexpected intraperitoneal injuries. The bladder should be opened at the dome and extraperitoneal laceration should be closed from the inside with 1 layer of absorbable suture.[9] Extraperitoneal bladder laceration or rupture has been treated with Foley catheters only, provided that (1) the urine is not infected and (2) laparotomy for associated rectal intraabdominal visceral injury or extensive bony fragments is not indicated.[12] The administration of antibiotics is routine in these injuries. In patients who have undergone primary repair of the bladder, the catheter may be removed after 7 to 10 days if cystography has demonstrated an intact bladder. In patients who are treated without primary repair, a cystogram should be obtained at 10 to 14 days and if there is continued leakage, the catheter should be maintained for at least 3 weeks with repeat cystography.

CURRENT DIAGNOSIS AND MANAGEMENT

Some years after our experience with casualties of the Vietnam War, a decision-making algorithm was published for the diagnosis and management of patients with pelvic fracture and suspected bladder or urethral injury or both.[10] It represents current (2004) prevailing thinking on this subject. Patients with pelvic fracture and suspected urological trauma without blood at the urethral meatus are catheterized and observed if the urine shows no evidence of hematuria. Patients with gross or microscopic hematuria undergo cystography with more than 300 mL of contrast medium with full and with drainage films. Those without extravasation are observed, whereas patients with limited extraperitoneal extravasation only are initially treated with catheter drainage. Surgical intervention, as previously described, is indicated for those with extensive extraperitoneal rupture and other associated organ injuries and in all with intraperitoneal rupture. Computed tomography or intravenous pyelogram for renal imaging is reserved for patients with suspected renal or ureteral injury. Retrograde urethrography is indicated if the patient has blood at the urethral meatus, is unable to void, or if medical personnel are unable to pass a catheter. Surgical intervention is indicated for significant urethral rupture with extravasation, with attempts at urethral stenting in all with urethral injury. (See Chapter 6, Blunt Pelvic Trauma With Posterior Urethral Disruption.)

In many patients with other severe organ system injuries and in the unstable patient, who often has significant hemorrhage, attempts at urethral stenting may best be delayed and accomplished in a more controlled setting with more sophisticated equipment and by more experienced personnel.

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