Trauma of the lower urinary tract

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Introduction

• Urologic trauma occurs in 10-20% of patients who experience major trauma
• Series of 31,380 trauma patients, bladder injury present in 3-4%
• About 10% with pelvic fractures have bladder injury however 83-94% of bladder injuries are from pelvic fractures.
Introduction

• OBGYN complications are most common cause of bladder injury during open surgery
• Extraperitoneal → pelvic fracture
• Intraperitoneal → direct trauma (penetrating/blunt) to dome of full bladder.
Clinical signs and symptoms

• Doesn’t occur as an isolated event
• Physical signs include
  – suprapubic tenderness, lower abdominal bruising, muscle guarding and rigidity, and diminished bowel sounds.
• Keep high suspicion in unconscious patients with pelvic trauma
• Most reliable indicator ➔ gross hematuria
• Difficulty catheterizing or blood at meatus ➔ ?
Radiographic Imaging

• **Absolute indication for immediate cystography**
  ➔ gross hematuria associated with pelvic fracture (29% have bladder rupture)

• **Relative indication after blunt trauma:**
  – gross hematuria without pelvic fracture
  – microhematuria with pelvic fracture

• **Penetrating injuries of the buttock, pelvis, or lower abdomen with *any* degree of hematuria warrant cystography**
Recap of clinical signs of bladder injury

- Suprapubic pain or tenderness
- Free intraperitoneal fluid on CT or ultrasound examination
- Inability to void or low urine output
- Clots in urine or clots noted in bladder on CT
- Enlarged scrotum with ecchymosis
- Abdominal distention or ileus
Radiographic imaging
What to use?

• Retrograde or stress cystography is nearly 100% accurate for bladder injury if performed appropriately
  – Bladder filled to sense of discomfort in awake patients or 350ml in unconscious patients with contrast
  – Plain film – 3 images (before contrast, after fill AP view, emptying phase)
  – If not done correctly can miss injuries very easily
  – Dense, flame-shaped collection in the pelvis ➔ characteristic of extraperitoneal extravasation
Figure 88–9. Plain film cystogram reveals extraperitoneal bladder rupture with extravasation into scrotum. Surgical exploration revealed anterior bladder neck and prostatic urethral laceration.
Radiographic Imaging

• Intraperitoneal extravasation is identified when contrast material outlines loops of bowel and/or the lower lateral portion of the peritoneal cavity

• CT cystography is now frequently selected as a more efficient means to assess the bladder

• Drainage film not required since retrovesical can be seen on CT unlike x-ray
## AAST Bladder trauma classification

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury type</th>
<th>Description of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Contusion, intramural hematoma</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Partial thickness</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
<td>Extraperitoneal bladder wall laceration &lt;2 cm</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Extraperitoneal (&gt;2cm) or intraperitoneal (&lt;2cm) bladder wall laceration</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Intraperitoneal bladder wall laceration &gt;2 cm</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple lesions up to grade III
From Moore et al. [2]; with permission
Figure 88–10. CT cystogram demonstrates contrast material surrounding loops of bowel consistent with intraperitoneal bladder rupture.
Management

• Differentiate: **INTRA vs. EXTRA** peritoneal
• Uncomplicated, intraperitoneal bladder rupture occurs, usual treatment is insert catheter and wait:
  – A large-bore (22 Fr) Foley catheter to promote adequate drainage—if output poor, fluoro cystography should be considered to ensure proper catheter placement
  – Cystography necessary to verify complete healing before catheter removal 14 days after injury
  – Occasionally, extravasation may persist for several additional weeks but will resolve with continuation of urethral catheter
Figure 88–11. A, Dense flame-shaped pattern of contrast extravasation in pelvis due to extraperitoneal bladder rupture. B, Repeated cystogram in same patient after 2 weeks of catheter drainage shows completely healed bladder.
Management

• In complicated extraperitoneal ruptures, many authors report less delayed complications with immediate open repair (e.g. fistula, clot retention, sepsis) so it is advised in such a setting.

• Stable patients, undergoing laparotomy for other associated injuries or internal fixation of pelvic fracture, I surgically repair the extraperitoneal rupture at the same setting.
Management

• All penetrating or intraperitoneal injuries resulting from external trauma should be managed by immediate operative repair
  – Larger than they seem and unlikely to heal spont.
  – Chemical Peritonitis

• When bladder injuries are explored after penetrating trauma without preliminary imaging, the ureteral orifices should be inspected for clear efflux
Complex injuries

• Any injury there also warrants, closure of UO and stented reimplantation of the ureter
• Antimicrobial 3 days periop for intraperitoneal leak
• Several studies have now shown that suprapubic tube drainage provides no benefit over urethral catheter drainage alone
• However in complicated cases both are preferred
Indications for immediate bladder repair

- Intraperitoneal injury from external trauma
- Penetrating or iatrogenic nonurologic injury
- Inadequate bladder drainage or clots in urine
- Bladder neck injury
- Rectal or vaginal injury
- Open pelvic fracture
- Pelvic fracture requiring open reduction and internal fixation
- Selected stable patients undergoing laparotomy
- Bone fragments projecting into bladder
Outcomes and complications

• Prompt diagnosis and appropriate management of bladder injuries promotes excellent results and minimal morbidity
• Serious complications are usually associated with delayed diagnosis or treatment
• Unrecognized bladder injuries may manifest as serous complications (e.g. acidosis, sepsis, peritonitis, respiratory difficulties)
Outcomes and Complications

• Unrecognized bladder neck, vaginal, and rectal injury associated with the bladder rupture can result in incontinence, fistula, stricture, and difficult delayed major reconstruction.

• Severe pelvic fractures may cause a transient or permanent neurologic injury and result in voiding difficulties despite an adequate bladder repair.
Urethral injury

• Urethral disruption injuries typically occur in conjunction with multisystem trauma from vehicular accidents, falls, or industrial accidents.

• Disruption of pelvic ring or pubic diasthesis associated with urethral disruption.

• Higher degree of displacement ➔ higher risk of injury.
Urethral injury

• "Straddle fractures" - involving all four pubic rami and fractures resulting in both vertical and rotational pelvic instability are associated with the highest risk of urologic injury

• Urethral injury has been reported to occur in approximately 10% of males and up to 6% of females sustaining pelvic fractures
Straddle Fracture
Mechanism of injury

• Posterior urethra ➔ adherent to the pubis via both the urogenital diaphragm and the puboprostatic ligaments
• Bulbomembranous junction is more vulnerable to injury during pelvic fracture than is the prostatomembranous junction
• Membranous urethral sphincter complex ➔ remain functionally intact while being avulsed vertically, posteriorly, and/or laterally
Diagnosis

• Triad:
  – blood at the meatus
  – inability to urinate
  – palpably full bladder

• However often absent, so diagnosis mainly done with **inability to pass catheter**

• Females may also develop proximal urethral avulsion injuries, although much more rarely than males
  – Vulvar edema and blood at the vaginal introitus
Imaging

• Urethrogram
  – Blood at meatus ➔ immediate retrograde urethrogram
  – Should be done in adequate manner with adequate images at correct angle
  – Direct urethroscopy advised more in females than urethrogram
Initial management

• **Immediate open reconstruction**
  - Abandoned in males for posterior urethral disruption ➔ unsatisfactory outcomes
  - Advised in female urethra, over a catheter due to possible fistula formation or obliteration of urethra
  - Concomitant vaginal lacerations also must be closed acutely to prevent vaginal stenosis
  - Delayed reconstruction is problematic because the female urethra is too short (about 4 cm) to be amenable for mobilization
Initial Management

• **Suprapubic Cystostomy**
  
  – Immediate suprapubic tube placement remains the standard of care in men with posterior urethral injuries
  
  – Repeatedly found by experts that suprapubic cystostomy can safely be used without complications throughout the course of care, including infection of hardware used to fix pelvic fracture
  
  – Catheter placed appropriately away from hardware and large in size
Initial management

• **Primary Realignment**
  – An attempt at primary realignment of the distraction with a urethral catheter is reasonable in patients whose condition is stable
  – When the urethral catheter is removed after 4 to 6 weeks, keep a suprapubic catheter because despite realignment, stricture will likely develop
  – Incomplete urethral tears are best treated by stenting with a urethral catheter
  – No evidence that a gentle attempt to place a urethral catheter can convert an incomplete ➔ complete tear
  – In no case is traction used after catheter placement
Figure 88–15. Retrograde urethrogram in a patient with a pelvic fracture shows complete disruption of posterior urethra.
Figure 88–16. Initial management of a female urethral disruption injury with suprapubic catheter drainage alone leads to complete urethral obliteration.
Complex injuries

• Some go for open exploration and realignment in cases: high-riding bladder or associated bladder neck tear in males

• Associated rectal injuries require open exploration, repair, irrigation, and placement of drains

• In posterior urethral disruption the rupture defect between the two severed ends fills with scar tissue, resulting in a complete lack of urethral continuity
Delayed reconstruction

- At 3 months, scar tissue stable enough to perform safe uretheroplasty, provided all other injuries taken care of (keep suprapubic)
- Preop necessitates proper imaging (up-n-downogram, flexible endoscopy, MRI)
- Endoscopically DVIU reserved for short partial stenosis (<1cm). Larger assoc. with no increased benefit and increased risk of complications
Surgical reconstruction

• Open posterior urethroplasty through a perineal anastomotic approach
• Care must be taken to carefully and meticulously excise all fibrotic tissue from the proximal urethral margin
• Alternatively, a combined AP approach (with or without partial pubectomy) has proved helpful in cases of severe fibrosis, fistula, previous failed anastomotic urethroplasty, and associated bladder neck injury and in pediatric cases
Figure 88–19. Intraoperative view of normal membranous urethra after fibrotic tissue was excised during perineal bulbomembranous urethroplasty.
Complications

• Some degree of impotence is noted in up to 82% of patients with pelvic fracture and urethral distraction injury
• These complications are usually the result of the injury itself and not of the treatment
• Incontinence, areflexic bladder, anejaculation noted as complications but low (2-4%)
• 5% to 15% of patients have recurrent stenosis at the anastomosis after posterior urethroplasty
Anterior Urethral injury

• Most common after straddle fracture and bulbar urethra most likely affected
• Small percentage result from direct trauma
• High index of suspicion must be maintained as well, with same signs and sx as post. Urethra
• Primary morbidity of straddle injury is urethral stricture, may become symptomatic years later
Initial management

• Divided into 3 groups: contusion, incomplete and complete disruption

• Contusion and incomplete disruption treated with urethral catheter diversion alone

• Complete disruption
  – Initial suprapubic cystostomy
  – Primary realignment show promising results with respect to stricture rate and ED in patients with straddle injuries of lesser magnitude
Initial Management

- Primary surgical repair recommended for patients with low velocity gunshot wounds.
- Debridement of the corpus spongiosum after trauma should be limited because corporeal blood supply is usually robust → spontaneous healing.
- Initial suprapubic urinary diversion recommended after high-velocity gunshot wounds, followed by delayed reconstruction.
Delayed reconstruction

- Retrograde urethrogram and voiding cystourethrogram should be obtained to define the site and length of the obliterated urethra clearly.
- Anastomotic urethroplasty in totally obliterated bulbar urethra after straddle injury.
- Endoscopic incision through the scar tissue of an obliterated urethra is doomed to failure.
- Open repair ➔ delayed for several weeks after instrumentation to allow the urethra to stabilize,
- 2-months of suprapubic diversion prudent preoperatively to optimize conditions for repair of complex or recurrent stricture.
AUA Bladder trauma guidelines

• Clinicians must perform retrograde cystography (plain film or CT) in stable patients with gross hematuria and pelvic fracture. (Standard; Evidence Strength: Grade B)

• Clinicians should perform retrograde cystography in stable patients with gross hematuria and a mechanism concerning for bladder injury, or in those with pelvic ring fractures and clinical indicators of bladder rupture. (Recommendation; Evidence Strength: Grade C)

• Surgeons must perform surgical repair of intraperitoneal bladder rupture in the setting of blunt or penetrating external trauma (Standard; Evidence Strength: Grade B)

• Clinicians should perform catheter drainage as treatment for patients with uncomplicated extraperitoneal bladder injuries. (Recommendation; Evidence Strength: Grade C)

• Surgeons should perform surgical repair in patients with complicated extraperitoneal bladder injury. (Recommendation; Evidence Strength: Grade C)

• Clinicians should perform urethral catheter drainage without suprapubic (SP) cystostomy in patients following surgical repair of bladder injuries. (Standard; Evidence Strength: Grade B)
AUA Urethral trauma guidelines

- Clinicians should perform retrograde urethrography in patients with blood at the urethral meatus after pelvic trauma. (Recommendation; Evidence Strength: Grade C)
- Clinicians should establish prompt urinary drainage in patients with pelvic fracture associated urethral injury. (Recommendation; Evidence Strength: Grade C)
- Surgeons may place suprapubic tubes (SPTs) in patients undergoing open reduction internal fixation (ORIF) for pelvic fracture. (Expert Opinion)
- Clinicians may perform primary realignment (PR) in hemodynamically stable patients with pelvic fracture associated urethral injury. (Option; Evidence Strength: Grade C)
- Clinicians should not perform prolonged attempts at endoscopic realignment in patients with pelvic fracture associated urethral injury. (Clinical Principle)
- Clinicians should monitor patients for complications (e.g., stricture formation, erectile dysfunction, incontinence) for at least one year following urethral injury. (Recommendation; Evidence Strength: Grade C)
- Surgeons should perform prompt surgical repair in patients with uncomplicated penetrating trauma of the anterior urethra. (Expert Opinion)
- Clinicians should establish prompt urinary drainage in patients with straddle injury to the anterior urethra. (Recommendation; Evidence Strength: Grade C)
Bladder Trauma Management

Cystogram / CT Cysto

Intraperitoneal
  ↓
  Surgical Closure

Extraperitoneal
  ↓
  Catheter Drainage

Evaluation

Retrograde Urethrogram

Posterior urethral Injury

Partial
  IDC
  SPC

Complete
  SPC
  Primary realignment