BLADDER RUPTURE

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Harvard Medical School Year IV
Gillian Lieberman, MD
FRIDAY NIGHT IN THE READING RM

TWO TRAUMA PATIENTS JUST CAME IN

• Patient 1:
  – 38 yo female Pedestrian struck by 30 mph car, hit windshield, thrown 30 ft with 30 seconds LOC
  – AVSS, Drunk, Abrasions to face and arms
  – Abdomen distended but soft, Nontender, Normal DRE
  – Gross Hematuria

• Patient 2:
  – 25 yo male unrestrained Passenger in high speed MVC, LOC and Hypotensive during 10 minute extraction
  – AVSS, agitated, Abdomen Nontender, Normal DRE
  – Unstable Pelvis and Microscopic Hematuria
ANATOMY: PELVIS

Associated with Bladder Rupture:
Diastasis of Pubic Symphysis or SI joint
Fractures of Ilium, Pubic Rami, Sacrum
Patient 1: AP Pelvis

Left Sacral Ala Fractured

Left Pubic Rami Fractured
Patient 1: Axial pelvis CT

- Rib Fracture
- Superior Pubic Ramus Fracture
- Left Inferior Pubic Ramus Fracture
Patient 2: Ap pelvis

Diastasis of Right SI joint

Diastasis of Pubic Symphysis
Patient 2: Axial pelvic CT

Left Inferior Pubic Ramus Fracture

Right Sacroiliac Diastasis
? Bladder Rupture (BR)

- INTRAPERITONEAL? (IPBR)
- EXTRAPERITONEAL? (EPBR)
# Radiologic Classification

## Bladder Trauma

<table>
<thead>
<tr>
<th>Contusion</th>
<th>Intramural injury/haematoma</th>
<th>NO ESCAPE of urine or contrast</th>
<th>Conservative management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra</strong></td>
<td>Tear in bladder dome</td>
<td>Fluids ESCAPE ➔ PERITONEUM</td>
<td><strong>Surgical management!</strong></td>
</tr>
<tr>
<td>Peritoneal Rupture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Extra</strong></td>
<td>Tear in bladder wall</td>
<td>Fluids ESCAPE ➔ SOFT TISSUES</td>
<td><strong>Conservative management</strong></td>
</tr>
<tr>
<td>Peritoneal Rupture</td>
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</table>
QUICK ANATOMY REVIEW

Bladder is EXTRAPERITONEAL!

Male

Female

Note relationship between Bladder & Pubic Symphysis

Gray’s Anatomy www.barbtleby.com
INCREASED RISK
FOR BLADDER RUPTURE!

Extremes of life: Elderly and babies
Because bladder projects above pubic symphysis:

BPH: Any patient with a full distended bladder eg s/p ETOH at higher risk
Patients who need a bladder evaluation:

- **HISTORY:**
  - Trauma patients
  - With abdominal pain

- **PHYSICAL:**
  - Hematuria

- **TRAUMA SERIES:**
  - Pelvic fractures
FIRST DECISION:

? Obtain RUG

Rule out urethral tear!

RISK FACTORS
- Male
- Scrotal hematoma
- Blood at meatus
- High-riding prostate
- Unable to void

RUG: Retrograde Urethrogram
SECOND DECISION:
?Obtain CYSTOGRAM

Cystogram
Fluoroscopic or CT
If BR suspected

can’t rely on I+ CT!

No extravasation of contrast on I + CT

Contrast extravasates with CT Cystogram

I.e. need a CT Cystogram

Radiol Clin North Am 1999
### IPBR vs EPBR

<table>
<thead>
<tr>
<th></th>
<th>INTRAPERITONEAL</th>
<th>EXTRAPERITONEAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROPORTION</strong></td>
<td>10-20%</td>
<td>80-90%</td>
</tr>
<tr>
<td><strong>MOST HAVE PELVIC FX</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>CAUSATIVE FORCES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blunt (seat belt)</td>
<td></td>
<td>Shearing</td>
</tr>
<tr>
<td>To Lower abdomen</td>
<td></td>
<td>To bladder base</td>
</tr>
<tr>
<td><strong>EXTENSION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruptures at dome</td>
<td></td>
<td>Extends into prevesical soft tissues, perineum, scrotum, thigh, anterior abdominal wall, retrorectal/presacral sp.</td>
</tr>
<tr>
<td>Extends into peritoneal cavity</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MANAGEMENT</strong></td>
<td>Surgical</td>
<td>Conservative</td>
</tr>
</tbody>
</table>

**URINE = NONCOMPRESSIBLE FLUID!**

**DISTENDED BLADDER = THIN WALL!**
IPBR PATTERN ON CYSTOGRAPHY

GENERAL FEATURES

- Smooth, regular contours
- Contrast accumulates near dome and extends laterally filling peritoneal cavity
- Surrounds bowel, forming gas-filled defects surrounded by circular segments of contrast
- Scalloped effect near paracolic recesses, haustra
- May outline liver margin

Ney and Fiedenberg, 1981
OUTLINING LOOPS

Outline of liver margin and peritoneal reflection

Ney and Fiedenberg, 1981

Brian Camozzi www.weather.com
IPBR PATTERN
CT CYSTOGRAPHY

GENERAL FEATURES

• Smooth contours
• Contrast material around bowel loops
• Flows between mesenteric folds
• Accumulates in paracolic gutters, rectouterine & rectovesical pouches

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EPBR PATTERN ON CYSTOGRAPHY

GENERAL FEATURES
- Often over lower half of bladder
- Streaky, patchy
- Irregular patterns
- Spreads along fascial planes and spaces
“…like rays of sun bursting through a breaking cloud…”

Friedland, 1983
SUNBURST PATTERN

Ney and Fiedenberg, 1981

Seen with Extraperitoneal bladder ruptures

James Lucas www.weather.com
EPBR PATTERN
CT CYSTOGRAPHY

GENERAL FEATURES

• Variable path of contrast spread
• Dense, flame-shaped
• Often into perivesical and prevesical space (Space of Retzius)
• May flow into presacral space
• Dissects fascial planes

Radiol Clin North Am, 1999
TEARDROP PATTERN ON CYSTOGRAPHY

GENERAL FEATURES

- Bladder looks high and elongated
- Compression by pelvic hematoma
- Can impair voiding
- Not necessarily ruptured

Ney and Fiedenberg, 1981
Extravasation of contrast from teardrop bladder associated with extraperitoneal rupture.

Teardrop bladder associated with extraperitoneal rupture and bladder neck fracture.

This patient had a teardrop bladder with rupture.

Ney and Fiedenberg, 1981
PATIENT 1

I+ AbdominoPelvic CT SCAN

Intraperitoneal fluid: 4 HU

Hematoma
Bladder with Foley
Uterus
Rectum
PATIENT 2

I+ AbdominoPelvic CT SCAN

Intraperitoneal fluid: 4 HU

SI diastasis with bone fragment
# DDX for FREE

## INTRAPERITONEAL FLUID

### # 1: THINK BLOOD (35-70 HU)

**OUR PATIENTS:** LOW ATTENUATION (4 HU)!

- BILE LEAK?
- URINE LEAK?
- BOWEL PERF?
- ASCITES?
- CHYLOPERITONEUM?

### I+ CT CYSTOGRAM SHOWED EXTRAVASATION:

- BLADDER RUPTURE?
- URINE LEAK FROM UPPER TRACT?
- (ENTEROVESICAL FISTULA WITH BOWEL PERF?)
PATIENT 1
CT CYSTOGRAM

Air in bladder due to instrumentation

INTRAPERITONEAL EXTRAVASATION OF CONTRAST
?AREA OF HIGH ATTENUATION?
Extraperitoneal BR? Hematoma?

BIDMC 2001
PATIENT 2
I+ CT SCAN & CT CYSTOGRAM

INTRAPERITONEAL EXTRAVASATION OF CONTRAST
Note: No Ureteral disruption

Air in Subcutaneous Tissues
FOLLOW-UP: PATIENT 1

I+ CT: 5 days later

After Conservative (!) Management, NO CONTRAST LEAK

Intraluminal air not yet resolved

Anterior pelvic clot indenting bladder

BIDMC 2001
FOLLOW UP: PATIENT 1
Fluoroscopic Retrograde Cystogram: 12 d. later

NO LEAK

AP

Oblique

BIDMC 2001
FOLLOW-UP: PATIENT 2

POSTOPERATIVE PELVIC CT: 3 days later

- Closed Reduction of Right Hemipelvis
- Percutaneous Fixation of Posterior SI joint Dislocation
- Intraoperative Bladder Repair
BLADDER RUPTURE

• ETIOLOGY: Trauma
  – 67-86% Blunt
    • 90% MVC
  – Rarely ruptures due to Malignancy, Obstruction, Drugs
  – HOWEVER, of abdominal injuries that require surgery, only 2% are Bladder Ruptures!

• IF EQUIVOCALE IMAGING:
  – Flexible cystoscopy

Translation: Urologic surgeons sleep through 98% of traumas 😊
## HISTORY

- **TRAUMA** (MVC, Fall)
- **PAIN** (Abdominopelvic)

## PHYSICAL EXAM

- **HEMATURIA** (90% of IPBR) Gross more likely but can have major GU injury with only Microscopic (DEGREE DOESN’T correlate with SEVERITY)
- **UNSTABLE PELVIS**

## TRAUMA SERIES

<table>
<thead>
<tr>
<th>Plain films: Pelvic Scout XRAY</th>
<th><strong>PELVIC FRACTURES</strong> (&gt;95% of EPBR) (Scott et al, 1997)</th>
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<tbody>
<tr>
<td><strong>I+ CT</strong></td>
<td>Less accurate than Retrograde Cystography (Haas et al, 1999)</td>
</tr>
<tr>
<td>Often done to R/O other injuries</td>
<td>PELVIC FLUID is a significant predictor of BR (Morgan et al, 2000)</td>
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### SUMMARY part two

#### CYSTOGRAM

<table>
<thead>
<tr>
<th>Study of choice</th>
<th>Routine:</th>
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<tr>
<td>IF BLOOD at MEATUS → RUG</td>
<td>AP, Both Obliques, Postvoid</td>
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**NOTE:** MUST TRULY DISTEND BLADDER

- Accuracy 85-100% if use
- 400 ml  (Dubinsky et al, 1999)
- 300 ml  (Morey et al, 1999)

#### CT CYSTO:

Recent studies show EQUAL accuracy to plain cystography

#### ULTRASOUND?

- If doing Sonography already, look at bladder!?  
- • Transabdominal Sonogram: showed intraperitoneal fluid adjacent to dome of bladder, confirmed with CT cystogram (Dubinsky et al, 1999)
MANAGEMENT

• EXPLORE IN O.R. IF
  – Penetrating Trauma
  – Urethra, Bladder neck, Vagina, or Rectum damaged

• MOST IPBR → O.R.
  – “IPBR occurring after blunt trauma should always be reconstructed emergently” (Morey et al, 1999)
  – Risk peritonitis and absorption of electrolytes

MOST EXBR MANAGED CONSERVATIVELY
  – 1 wk broad-spectrum Abx
  – Decompress bladder with catheter until heals (2 wks)
  – Then repeat Cystography
  – Repair if pt going to OR anyway

• DIVERT URINE OUTPUT IF
  – Emergent surgery needed before bladder repair
  – Ex: can Externalize Stents
TAKE HOME MESSAGES

• PELVIC FRACTURE
  1. THINK: Possible Bladder Rupture
  2. DO: Cystogram—not just I+ CT

• MEN
  1. Must do RUG FIRST if any RF for Urethral Injury

• INTRAPERITONEAL ➔ SURGICAL
  EXTRAPERITONEAL ➔ CONSERVATIVE

• Empty bladder
  – Before any road trip
  – Never ever drink & drive
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  – My Classmates, My Parents, and My Roommate
  – Andrew and Lynda

THANK YOU FOR the CASES & the TEACHING!
REFERENCES


WEBSITES