Urogenital Injuries
The role of radiology

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Renal trauma

"Except in the rare instance of a shattered kidney or major renal vascular laceration with significant hemorrhage, genitourinary injuries seldom pose a threat to life." Michael Runyon, uptodate, 2012

- MVCs, falls, direct blows, and lower rib fractures
- Significant decelerating forces may cause avulsion of the renal pedicle or renal artery dissection.
- In children, bicycle accidents represent a prominent mechanism of renal injury

Who needs imaging?

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major blunt trauma to the abdomen or flanks</td>
<td>MDCT</td>
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<tr>
<td>Minor blunt trauma to the abdomen or flanks with macrohematuria</td>
<td>MDCT</td>
</tr>
<tr>
<td>Penetrating trauma to the abdomen with macro-or microhematuria</td>
<td>MDCT</td>
</tr>
<tr>
<td>Hemodynamically unstable patient who responds to fluid resuscitation</td>
<td>MDCT</td>
</tr>
<tr>
<td>Hemodynamically unstable patient without fluid response</td>
<td>IVP</td>
</tr>
<tr>
<td>Hemodynamically stable patients with microhematuria only</td>
<td>Observation and urine control</td>
</tr>
</tbody>
</table>

Miller, S. Radiologic clinincs of N-America, 1996
Miller, E. J Urol 1995,
EAU guidelines on urological trauma. Eur Urol 2005

Outline

- Kidney injuries
- Ureter injuries
- Bladder and urethra
- Scrotal trauma

- Occurs in 8-10% of all abdominal trauma patients
- Conservative treatment in 90%
- Explorative laparatomy in 10%
  - Of these 13% nephrectomy
- Absolute indication for surgery:
  - Life threatening bleeding
  - Bilateral main vessel injury or unilateral vessel injury in singel kidney
  - Pulsating retroperitoneal hematoma

Mirvis, S. Radiologic clinincs of N-America, 1996
Miller, E. J Urol 1995,
EAU guidelines on urological trauma. Eur Urol 2005

Renal injuries without hematuria

- Hematuria does not correlate with grade of renal injuries
- No hematuria in case of:
  - Thrombosis of segmental arteries
  - Injury to hilar vessels
  - Disruption of the PUJ
  - Concomitant complete rupture of the urethra

Other modalities than MDCT

- IVP: In hemodynamic unstable patients
  - "It provides important information for decision-making in the critical time of urgent laparotomy concerning the injured kidney as well as the presence of normal functioning kidney on the contralateral side" (Morey, AF 1999 J Urol)
- Ultrasound: Plays a minor role: Sensitivity for retroperitoneal injuries < 50%. CEUS of kidneys has a sensitivity of ca. 80%. Can be used for follow-p studies
- Angiography: In selected cases, for embolisation and revascularisation.
- MRI:
  - "Failed to visualize urinary extravasation. MR is not first choice in managing the patient with trauma" (Eur Urol, Guidelines on urological trauma 2005)

MDCT techniques

Start with 20 ml i.v. contrast directly after head and neck scanning

Grading of renal injuries (AAST)

- Grade 1
  - Contusion (microscopic or macroscopic hematuria)
  - Subcapsular, nonexpanding hematoma without parenchymal laceration

- Grade 2
  - Nonexpanding perirenal hematoma confined to renal retroperitoneum
  - Laceration <1 cm depth of renal cortex without urinary extravasation

- Grade 3
  - Laceration >1 cm depth of renal cortex without collecting system rupture or urinary extravasation
• Grade 4
  – Parenchymal laceration extending through renal cortex, medulla, and collecting system
  – Segmental renal artery or vein injury with contained hemorrhage

• Grade 5
  – Completely shattered kidney
  – Avulsion of renal hilum, devascularizing the kidney

Renal injury

• Most renal injuries are grade 1-3 without the need of further treatment
• Grade 4 and 5 injuries are treated conservatively or operatively, depending on the clinical status
• Revascularisation:
  – Successful 22-64%
  – Function: 9-21% reestablished
• Embolisation in selected cases
Complications

- Urinoma
- Hydronephrosis
- Pyelonephritis
- Thrombosis of renal vein
- Page Kidney

Ureter injuries

- Rare injuries
  - 1% in blunt trauma
  - 4% in penetrating trauma

- Causes
  - Gynecological 55%
  - Abd. Surgery 10%
  - Urology 10%
  - Trauma
    - Blunt 18%
    - Penetrating 7%
MOI

Clinical features

- Often delayed diagnosis for days or even weeks
- Delayed diagnoses increases complication rates
- Typical signs in delayed diagnosis
  - Peritonitis, ileus, leucocytosis, fever, sepsis
  - Fistula to vagina
  - Long drainage time

Diagnosis

- (IVP), MDCT with late series
- Retrograde and antegrade pyelography
- In partial rupture contrast may pass through the site of injury
Injuries to the urine bladder

- In patients with full bladder
- In 5% of patients with pelvic fracture
- Combination of macroscopic hematuria and pelvic fracture → high risk of bladder injury
- Intra-, ekstraperitoneal rupture
- Conventional cystography or CT cystography

Extraperitoneal bladder rupture

- Most common (80-90%)
- Combined rupture in up to 12%
- Mechanism of injury: Direct penetration of bone fragment, shearing forces
- Diagnosis: Ekstraperitoneal contrast leakage. Irregular contrast stripes in the previsical, perivesical, presacral, inguinal spaces, in the upper part of the thigh.

Extraperitoneal rupture cont.

- Contrast leakage to the perineum and scrotum in case of simultaneous rupture of the posterior urethra
- Contrast can pass cranially in the retroperitoneal space and anteriorly around the rectus muscles
- Conservative treatment. After 10 days, leakage has stopped
Intraperitoneal bladder rupture

- Most commonly rupture of the bladder roof
- Typically blunt trauma to full bladder
- Intrapertoneal leakage, bladder often deflated
- Needs surgical repair

Cystography

- Precontrast image
- Use 300-400 ml contrast (240 mg iodine/ml)
- Front and oblique images
- Image after contrast evacuation
- Should be performed after pelvic angiography

CT-cystography

- Supplement to abdominal and pelvic CT
- Fill the bladder with 300-400 saline, with 3-4% contrast (300-400 mg iodinane/ml)
- Low dose imaging
- Post void imaging usually not necessary

Grading

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
</tr>
<tr>
<td>I</td>
<td>Contusion, intramural hematoma</td>
</tr>
<tr>
<td>I</td>
<td>Partial thickness</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
</tr>
<tr>
<td>Extraperitoneal bladder wall laceration &lt;2 cm</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
</tr>
<tr>
<td>Extraperitoneal (&gt;2 cm) or intraperitoneal (&lt;2 cm) bladder wall laceration</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
</tr>
<tr>
<td>Intraperitoneal bladder wall laceration &gt;2 cm</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
</tr>
<tr>
<td>Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)</td>
<td></td>
</tr>
</tbody>
</table>
66-year-old woman who was struck by motor vehicle

Table 1  Sensitivity, Specificity, PPV, and NPV of CT Cystography and Conventional Retrograde Cystography for the Diagnosis of Blunt Bladder Injuries and Specifically of Extraperitoneal and Intraperitoneal Types of Injury in 212 Patients Evaluated by Both Studies After Nontrivial Blunt Torso Trauma

<table>
<thead>
<tr>
<th></th>
<th>Blunt Bladder Injuries (n = 10)</th>
<th>Extraperitoneal Injury (n = 14)</th>
<th>Intraperitoneal Injury (n = 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTC</td>
<td>94.7</td>
<td>92.9</td>
<td>80</td>
</tr>
<tr>
<td>CRC</td>
<td>81.8</td>
<td>99.5</td>
<td>100</td>
</tr>
<tr>
<td>Sensitivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specificity</td>
<td>100</td>
<td>99.5</td>
<td>99.5</td>
</tr>
<tr>
<td>PPV</td>
<td>100</td>
<td>99.5</td>
<td>99.5</td>
</tr>
<tr>
<td>NPV</td>
<td>99.5</td>
<td>99.5</td>
<td>99.5</td>
</tr>
</tbody>
</table>

PPV, positive predictive value; NPV, negative predictive value; CTC, computed tomographic cystography; CRC, conventional retrograde cystography.

Quagliano J Trauma 2006

Urethral injuries

Anatomy

•Present in 10% of male patients with major pelvic fracture
Posterior urethral disruption from a pelvic fracture, showing disruption between the membranous urethra and the bulbar urethra.


Posterior urethral injuries associated with unstable fractures (straddle fx and diastasis in IUJ)

Anterior urethral injuries often incompression injuries, (bicycle)

Symptoms:
  – Blood at the meatus (Sensitivity 57%)
  – Voiding problems,
  – Urine retention
  – Prostate elevation (sensitivity 37%)

Katheter insertion: One try!

Urethragraphy

• Thin HSG catheter at the meatus. Fill ballon with saline and the catheter with contrast
• Start with precontrast images
• Insert 5 ml and expose simultaneously.
• At least one front and one oblique image
Injury to the testis and scrotum

- Hematocele, hydrocele
- Intra. Or extratesticular hematoma
- Devascularization
- Total rupture
- Wide range of sensitivity of ultrasound for testicular injuries
- Important to rule out rupture of the tunica albuginea

Injury to testis and scrotum cont.

- Most of the injuries are treated conservatively
- Surgical treatment in case of rupture and devascularization
- Delay of surgery decreases chance to preserve the testicle from 90% down to 45%