Pathology

- Congenital abnormality
- Urinary tract obstruction
- Cystic and solid renal mass
- Infection
- Trauma of KUB system
Urinary tract trauma
KUB Trauma

I. Renal trauma
II. Ureteric trauma
III. Bladder trauma
IV. Urethral injury
Renal Trauma

Renal trauma

- Blunt renal trauma: 90%
- Penetrating renal injury: 10%
Plain film

- Look for...
  1) Fracture of the lower ribs
  2) Fracture transverse process at T12-L3 level
  3) Abnormal soft tissue shadow → obscuration of kidney or psoas shadow
  4) Localized bowel ileus
  5) Scoliosis of the lumbar spine to contralateral side
  6) Pleural effusion or hemothorax
CT KUB

- CT scan with IV contrast injection
  - Corticomedullary phase
  - Nephrographic phase
  - Excretory phase* (delayed 5-10 minutes)

- If clinical unstable
  - Single shot IVP
  - Bolus 100 ml contrast medium injection
  - Film KUB at 15 minutes
CT scan

- Gold standard
- Contrast enhancement
  - Intravenous contrast injection
  - Oral contrast administration if possible
- Accurately identifies
  - Vascular injury
  - Parenchymal laceration
  - Urinary extravasation
  - Perirenal hematoma
  - Other intra-abdominal injuries
CT scan

- Nephrogenic phase
  - Detect active arterial extravasation
  - Parenchymal injury
- Excretory phase
  - 5 –10 minutes after contrast injection
  - Urinary extravasation
- Parenchymal and capsule injury
  - Renal contusion
  - Renal laceration: depth
  - Subcapsular hematoma
  - Perinephric hematoma
- Renal contusion
- Renal laceration
- Subcapsular hematoma
- Perinephric hematoma
Perinephric Hematoma
<table>
<thead>
<tr>
<th>Subcapsular hematoma</th>
<th>Perinephric hematoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Intact renal capsule</td>
<td>- Torn renal capsule</td>
</tr>
<tr>
<td>- Hematoma under renal</td>
<td>- Hematoma extend into</td>
</tr>
<tr>
<td>capsule</td>
<td>perirenal space</td>
</tr>
<tr>
<td>- Pressured effect to</td>
<td>- No or minimal pressured</td>
</tr>
<tr>
<td>underneath renal</td>
<td>effect</td>
</tr>
<tr>
<td>parenchyma</td>
<td></td>
</tr>
</tbody>
</table>
Multiple lacerations = Shattered kidney
- Collecting system injury
  - Urinary extravasation
  - UPJ injury
Excretory phase
- Vascular injury
  - Renal artery avulsion
  - Renal artery thrombosis
Indication for investigation

Blunt abdominal trauma

1. Gross hematuria
2. Microscopic hematuria with shock (SBP ≤ 90 mmHg)
3. Adjacent organ injury, flank pain/contusion/ palpable mass
4. Deceleration injury
5. Pediatric + UA: RBC > 50 cell/HPF
Indication for investigation

Penetrating injury

1. Any degree of hematuria
2. Deep cut wound
3. Hemodynamically unstable
## Radiologic classification of renal injuries

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Minor injury</td>
<td>- Renal contusion&lt;br&gt;- Intrarenal and subcapsular hematoma&lt;br&gt;- Minor laceration, limited perinephric hematoma without extension to the collecting system&lt;br&gt;- Small subsegmental cortical infarction</td>
</tr>
<tr>
<td>2 Major injury</td>
<td>- Major laceration through cortex to the medulla or collecting system with/without urine extravasation&lt;br&gt;- Segmental renal infarction</td>
</tr>
<tr>
<td>3 Catastrophic injury</td>
<td>- Multiple renal lacerations&lt;br&gt;- Vascular injury involving the renal pedicle</td>
</tr>
<tr>
<td>4</td>
<td>- Ureteropelvic junction injury (avulsion, laceration)</td>
</tr>
</tbody>
</table>
## Renal injury scale (AAST)
The American Association of Surgeons in Trauma

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury description</th>
</tr>
</thead>
</table>
| 1     | - Hematuria with normal imaging studies  
      | - Contusions         
      | - Nonexpanding subcapsular hematomas |
| 2     | - Nonexpanding perinephric hematomas confined to the retroperitoneum  
      |   - Superficial cortical lacerations (<1 cm) |
| 3     | - Lacerations > 1 cm depth without extension into the collecting system or urinary extravasation |
| 4     | - Lacerations extending through collecting system  
      |   - Injuries to main renal a/v with contained hemorrhage  
      |   - Segmental infarctions without associated laceration |
| 5     | - Shattered or devascularized kidney  
      |   - UPJ avulsions  
<pre><code>  |   - Complete laceration or thrombus of the main renal a/v |
</code></pre>
<table>
<thead>
<tr>
<th>Radiologic classification</th>
<th>AAST</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Minor injury</td>
<td>1</td>
<td>Minor injuries… No follow up imaging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Contusions</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>- Subcapsular hematoma</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>- Laceration without collecting system involvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Small subsegmental infarction</td>
</tr>
<tr>
<td>2 Major injury</td>
<td>4</td>
<td>- Lacerations … F/U CT at 36-72 hours to monitor extravasation from collecting system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Urinomas from urine extravasation … percutaneous drainage</td>
</tr>
<tr>
<td>3 Catastrophic injury</td>
<td>5</td>
<td>- Renal artery thrombosis or segmental artery injury … angiography where stenting or embolization is feasible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Renal pedicle injury or severely damaged and shattered kidney … surgical management</td>
</tr>
</tbody>
</table>
Renal angiogram
Grade 1: Minor trauma
Rx: Conservative treatment
Grade 2-4: Major trauma
Rx: Surgery or intervention
Suspected renal injury

Stable patient

US

Hematoma

CT scan

Angiogram

No hematoma

IVP

Unstable patient

Single shot IVP at OR
Ureteric trauma
Ureteric trauma

- Penetrating > blunt injury
  - Findings: contrast extravasation or obstruction

![Ureteric trauma images]
Bladder injury
Bladder injury

- Most from blunt trauma
- Clinical presentation
  - Suprapubic pain
  - Hematuria
  - Urinary ascites
- Plain film
  - Fracture and dislocation of pelvic bone (60%)
  - Soft tissue mass in pelvis (hematoma)
  - Air in urinary bladder (penetrating injury)

Investigation:
Cystogram or CT cystogram
1. **Bladder contusion**

   Incomplete tear of submucosal layer
   Normal or teardrop shape
2. Intraperitoneal bladder rupture

- Rupture bladder dome
  “Sudden increase intravesicular pressure in a full bladder”
- Surgical treatment
3. Interstitial bladder injury: rare

4. Extraperitoneal bladder rupture
   - Most common type
   - Associated with anterior pelvic ring fracture
   - Ruptured bladder base
   - Conservative
Urethral injury
1. Posterior urethral injury: associated with pelvic Fx
2. Anterior urethral injury: straddle injury

Bleeding per urethral meatus

R/O urethral injury first!

Retrograde urethrography
Normal urethrogram

- p: penile urethra
- b: bulbar urethra
- m: membranous urethra
- pr: prostatic urethra
- B: urinary bladder
Supradiaphragmatic injury
Infradiaphragmatic injury