Operative management – Renal Trauma

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Preliminary management

• shares common pathway with non-operative management

• ATLS resuscitation protocol
  • airway
  • breathing
  • circulation
  • disability assessment
  • exposure

  – primary survey
  – secondary survey
Renal imaging

• based on the clinical findings and the mechanism of injury
• clinical indications:
  – gross haematuria
  – microscopic (>5 RBCs per high-powered field [hpf]) or dipstick haematuria in a hypotensive patient (systolic blood pressure of <90mmHg recorded at any time since the injury)
  – history of rapid deceleration with evidence of multisystem trauma
  – penetrating chest and abdominal wounds with any degree of haematuria or suspicion of renal injury based on wound location
  – any child with urinalysis showing >50 RBC/hpf after blunt trauma
    • controversial
    • Stein et al, all paeds patient with any degree of hematuria
    • Morey et al, gross hematuria or RBC > 50/hpf
    • Campbell’s urology, all pediatric patients > 5 RBCs/HPF
• children more susceptible to renal injury due to:
  – the kidneys are lower in the abdomen, less well-protected by the lower ribs and muscles of the flank and abdomen
  – more mobile
  – have less protective peri-renal fat
  – proportionately larger in the abdomen than in adults

• hypotension is not a reliable sign

• if failure of conservative management, usually within 24 hours (median time 4 hours)
• CECT is the gold standard for genitourinary imaging in renal trauma
  – AV scanning 80s post contrast for nephrogenic phase to identify arterial extravasation
  – excretory scanning 10mins post contrast to identify parenchymal laceration and urinary extravasation
    • superior anatomical details
    • visualize other associated injury
    • non-enhancing kidney; renal pedicle injury
    • presence and location of the contralateral kidney
  – PPV
    • CECT (95.6%)
    • double dose IVU (90.9%)
    • US (78.8%)
# Staging of renal trauma

<table>
<thead>
<tr>
<th>GRADE*</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Microscopic or gross hematuria, urologic studies normal</td>
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<tr>
<td></td>
<td>Hematoma</td>
<td>Subcapsular, nonexpanding without parenchymal laceration</td>
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<tr>
<td>II</td>
<td>Hematoma</td>
<td>Nonexpanding perirenal hematoma confined to renal retroperitoneum</td>
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<tr>
<td></td>
<td>Laceration</td>
<td>&lt;1 cm parenchymal depth of renal cortex without urinary extravasation</td>
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<tr>
<td>III</td>
<td>Laceration</td>
<td>&gt;1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation</td>
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<tr>
<td>IV</td>
<td>Laceration</td>
<td>Parenchymal laceration extending through renal cortex, medulla, and collecting system</td>
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<tr>
<td></td>
<td>Vascular</td>
<td>Main renal artery or vein injury with contained hemorrhage</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Completely shattered kidney</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Avulsion of renal hilum, devascularizing the kidney</td>
</tr>
</tbody>
</table>

*Advance one grade for bilateral injuries up to grade III.

Surgical management

• indications:
  – absolute
    • hemodynamic instability with shock
    • expanding/pulsatile renal hematoma (usually indicating renal artery avulsion)
    • suspected renal pedicle avulsion (grade 5)
    • ureteropelvic junction disruption
  – relative (rare)
    • urinary extravasation together with nonviable tissue,
    • renal injury together with colon/pancreatic injury,
    • a delayed diagnosis of arterial injury (which most likely will need delayed nephrectomy)
Surgical exploration

- in acutely injured kidney is best done by a transabdominal approach
  - complete inspection of intra-abdominal organs and bowel
  - use of self retaining retractors (Bookwalter, Omnitract)
  - isolation and control of renal vessels before renal exploration
• vascular control
  – transverse colon is lifted superiorly onto the chest
  – the small bowel is lifted superiorly and to the right
  – incision is made over the aorta superior to the IMA to the ligament of Treitz (dotted line)

  – expose aorta, follow superiorly to the left renal vein, which crosses the aorta anteriorly
– if large haematoma obscures aorta, IMV can be used as landmark
– retroperitoneal incision just medial to IMV

– dissecting through the hematoma
– the anterior surface of the aorta can be identified and followed superiorly to the crossing left renal vein
• vessel loop to secure the left and right vein,
• control right and left renal arteries as they leave the aorta
• secure both arteries with vessel loops
• **Renal exposure**
  
  – incising the peritoneum lateral to the colon (white line of Toldt)
  
  – colon reflected medially off Gerota fascia
  
  – release of the splenic (left) or hepatic (right) attachments of the colon
– Gerota fascia is then opened
– injured kidney completely dissected from the surrounding hematoma
– if troublesome bleeding isolated vessels can be temporarily occluded with a vascular clamp or a vessel loop tourniquet
– in published literature there have been conflicting outcome reports of renal preservation rates with and without early vascular control
– “available data support an improved renal salvage rate with early vascular control because patients who require temporary vascular occlusion cannot be reliably identified before renal inspection” – Campbell Walsh Urology 10th Edition
• **Renal reconstruction**
  – principles
    • complete renal exposure
    • measures for temporary vascular control
    • debridement of nonviable tissue
    • hemostasis by individual suture ligation of bleeding vessels
    • watertight closure of the collecting system
    • if possible, coverage or re-approximation of the parenchymal defect
    • judicious use of retroperitoneal drains
– partial nephrectomy (polar injury)

– renorrhaphy (mid-renal injury)
– renal vascular injury (hilar renal injury)
  • uncommon
  • major injuries warrant expeditious nephrectomy
  • even in cases where repair is possible, the salvage rates are low
  • may have role in bilateral renal injury or single kidney
  • case reports of successful endovascular repair on blunt renovascular injuries (intimal flap with thrombosis)
  • delayed diagnosis (>8 hours), the kidney typically cannot be salvaged
  • risk of post repair hypertension
• **Damage control**
  – wound and area around the injured kidney are packed with laparotomy pads to control bleeding
  – return in 24 hours to explore and evaluate the extent of injury
  – may well be useful in managing complex renal injuries
  – to avoid total nephrectomy
• Nephrectomy
  – indications
    • extensive renal parenchymal injury
    • extensive vascular injury
    • combined injury
    • haemodynamic instability

• Post op follow up
  – involve physical examination
  – urinalysis
  – individualized radiological investigation (nuclear renal scans/excretory urogram)
  – serial blood pressure measurement
  – serum determination of renal function
• Complications
  – early (1 month)
    • bleeding
    • arteriovenous fistulae
    • infection
    • perinephric abscess
    • sepsis
    • urinary fistula
    • hypertension
    • urinary extravasation
    • urinoma
— late
  • bleeding
  • hydronephrosis
  • calculus formation
  • chronic pyelonephritis
  • hypertension
  • arteriovenous fistula
  • hydronephrosis
  • pseudoaneurysms

— hypertension (5%)
  • external compression from perirenal hematoma (Page kidney)
  • chronically because of compressive scar formation
  • renin-mediated hypertension
    — renal artery thrombosis
    — segmental arterial thrombosis
    — renal artery stenosis (Goldblatt kidney)
    — devitalized fragments
    — arteriovenous fistulae
Trauma

Blunt

- Hematuria
  - Microscopic (>5 RBC/HPF)
    - No shock
      - Selective renal imaging
      - Clinical follow-up
  - Gross or microscopic associated with shock (SBP <90)
    - Unstable
      - Abdominal exploration
        - Single-shot IVP on table
        - Abnormal or inconclusive
          - Renal exploration
    - Stable
      - Abdominal CT scan (IVP optional)
        - Grades III-V
        - Selective renal exploration

Penetrating

- Hematuria
  - Microscopic (>5 RBC/HPF)
    - Stable
      - Abdominal CT scan (IVP optional)
        - Grades III-V
        - Selective renal exploration
Adult renal trauma – blunt injury

Suspected adult blunt renal trauma

Determine hemodynamic stability

Suspected adult blunt renal trauma

Stable

Gross hematuria

Rapid deceleration injury or major associated injuries

Renal imaging

Grade 3–4

Observation, bed rest, Serial Hct, antibiotics

Grade 1–2

Observation

Observation

Retroperitoneal hematoma

Pulsatile or expanding

Abnormal IVP

Renal exploration

Rapid deceleration injury or major associated injuries

Microscopic hematuria

Normal IVP

Emergency laparotomy One-shot IVP

Unstable

Stable

Associated injuries requiring laparotomy
Adult renal trauma – penetrating injury

Suspected adult penetrating renal trauma

Determine hemodynamic stability

Stable

Renal imaging

Grade 3

Observation, bed rest, serial Ht, antibiotics

Grade 4-5

Associated injuries requiring laparotomy

Grade 1-2

Renal exploration

Unstable

Emergency laparotomy One-shot IVP

Normal IVP

Observation

Retroperitoneal hematoma

Stable

Pulsatile or expanding

Abnormal IVP
The End