Anatomy of the Kidney

Be suspicious of renal injury with broken ribs

Renal blood supply

Renal arteries

Renal veins

IVC

Image from www.trauma.org

Image from www.radiology.wisc.edu
Anatomy of the Kidney
Prevalence of Renal Trauma

- 10-20% of trauma pts. have GU involvement
- 45% of GU trauma is renal
- 20-30% of renal trauma pts. have associated abdominal injury
Mechanisms of Renal Trauma

• Blunt trauma (80%): MVA, falls, assaults

• Penetrating trauma (20%): gunshot, stabbing, impalement

• Predisposing factors: preexisting renal conditions (tumors, hydronephrosis), children, associated abdominal injuries
Clinical Presentation of Renal Trauma

- Gross or microscopic hematuria (absent in 5%)
- Flank pain/ecchymosis
- Hemodynamic instability
- Presence of other abdominal injuries
Patient 1: An illustration of imaging modalities

- 18 yo male sustained stab wound to R flank
  - P=180, BP 130/80, Hct 36
  - CXR nl.

- Why image and with which modality?
Indications for Imaging

- Gross hematuria
- Microscopic hematuria with hemodynamic instability
- Persistent microscopic hematuria
- Significant MOI
Radiologic Imaging of Renal Trauma

CT with IV contrast

- Gold standard, high sensitivity

- Immediate and delayed post-contrast images to view collecting system

- Allows diagnosis and staging

- Images abdomen and retroperitoneum

- Not for hemodynamically unstable pts.
Patient 1: CT with IV contrast

Normal attenuating kidney

Peri-renal hemorrhage
Patient 1: CT with IV contrast

Contrast extravasation
Patient 1: CT with IV contrast

Renal laceration with extravasation of contrast

Retroperitoneal hematoma
Radiologic Imaging of Renal Trauma Cont.

Intravenous pyelography

- Unable to evaluate abdomen and retroperitoneum
- Inadequate for grading renal injury
- Used in unstable pts prior to surgery to identify functioning contralateral kidney

Extravasation of contrast from R kidney

Image from Trauma.org
Radiologic Imaging of Renal Trauma Cont.

Renal Angiography

- Delineates vascular injury (intimal tears, pseudoaneurysm, AV fistula)
- Use when CT equivocal and continued hemorrhage
- Use for endovascular repair (embolization, stenting)
Radiologic Imaging of Renal Trauma Cont.

Renal ultrasound

- Bedside US in ED allows evaluation of abd/pelvic injury/fluid accumulation
- High false neg. rate for renal injury
- Used in areas without CT, or for follow up
Patient 2: An Illustration of Injury Staging

- 17 yo unrestrained driver
  MVA c/o RLQ pain
- VSS
- Hct 45.7, BUN 15, Cr 1.2
- CXR, cervical, lumbar, pelvic plain films nl.
- CT demonstrates renal laceration
- How severe? How manage?
AAST Organ Injury Scale - Renal Injury

**Grade I**
- **Contusion:** Microscopic or gross hematuria, urological studies normal
- **Hematoma:** Subcapsular, nonexpanding without parenchymal laceration

**Grade II**
- **Hematoma:** Nonexpanding perirenal hematoma confined to renal retroperitoneum
- **Laceration:** <1cm parenchymal depth of renal cortex without urinary extravasation

Grade I and II injuries managed conservatively (observation, serial Hct)
AAST Renal Injury Scale Cont.

**Grade III** Laceration: >1 cm depth of renal cortex, without collecting system rupture or urinary extravasation

**Grade IV** Laceration: Parenchymal laceration extending through the renal cortex, medulla and collecting system

Vascular: Main renal artery or vein injury with contained hemorrhage

Grade III and IV injuries are now managed conservatively
AAST Renal Injury Scale Cont.

**Grade V**  
Laceration: Completely shattered kidney  
Vascular: Avulsion of renal hilum which devascularizes kidney

Surgery! Salvage vs. nephrectomy
Patient 2: Grading the Renal Injury

Adrenal hemorrhage
Patient 2: Grading the Renal Injury

- Laceration renal cortex >1cm
- No involvement of collecting system or hilar vasculature
- Grade III
- Conservative management
Patient 1: Grading/Management

- Laceration of renal cortex extending into collection system
- Large perirenal and retroperitoneal hemorrhage
- Grade IV

• Conservative management with resolution in 2 mo
Renal Trauma Conclusions

• Look for renal trauma in pts with abdominal trauma and significant MOI

• CT with contrast

• Grade severity of injury

• Injuries requiring surgery: vascular injury, shattered kidney, expanding hematoma

• 80-90% renal injuries treated conservatively with remarkable resolution!
References

“Abdominal and pelvic CT” at http://brighamrad.harvard.edu


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