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2018 AUA Life Long Learning Prep Course: Urologic Trauma

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@JSimhan

Disclosures

- Boston Scientific – Consultant
- Coloplast – Consultant

THE JOURNAL of UROLOGY®
Official Journal of the American Urological Association

Urotrauma: AUA Guideline

Allen F. Morey, Steve Brandes, Daniel David Dugi III, John H. Armstrong, Benjamin N. Breyer, Joshua A. Broghammer, Bradley A. Erickson, Jeff Holzbeierlein, Steven J. Hudak, Jeffrey H. Pruitt, James T. Reston, Richard A. Santucci, Thomas G. Smith III and Hunter Wessells

From the American Urological Association Education and Research, Inc., Linthicum, Maryland

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Case

- S.D. 24 year old falls from skateboard
- Gross hematuria X 2, voiding easily, no clots, painless
- Large ecchymotic area noted on R flank
- HCT 28, Cr 1.2
- Hemo stable

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Adult BLUNT Renal Trauma:

Who Needs Immediate Imaging?

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Renal – Whom to Image

1. "…Perform diagnostic imaging with IV contrast enhanced CT in stable blunt trauma patients with gross hematuria or microscopic hematuria and SBP < 90mmHG".

   (Standard; Evidence Strength: Grade B)

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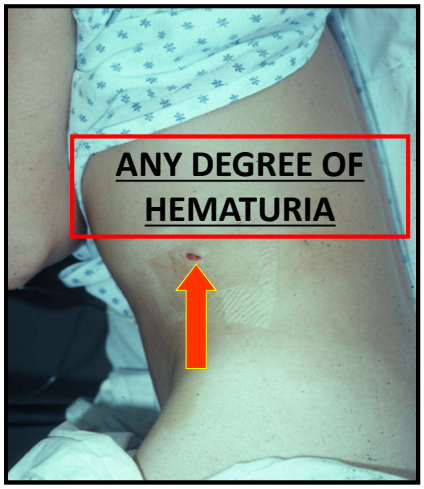
Penetrating Trauma: Higher Index of Suspicion



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Renal Imaging for Signs and Symptoms

2. "…Perform diagnostic imaging with IV contrast enhanced CT in stable trauma patients with mechanism of injury or PE findings concerning for renal injury".

(Recommendation; Evidence Strength: Grade C)

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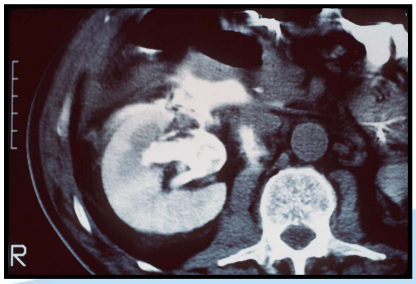
Renal Trauma Staging (CT): Immediate and Delayed Phases

2 Phase Contrast CT

- Vascular (30-45 sec)
- Excretory (5-10 min)



BJU Intl 2004:94

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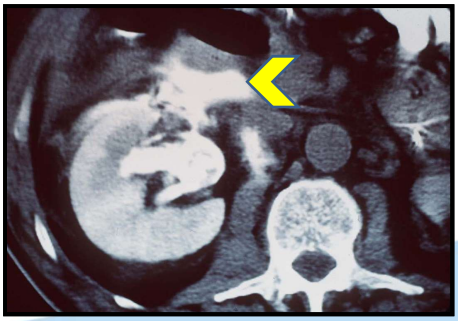
Renal Trauma Imaging: Abd/Pelvic CT with Immediate + Delayed Views

Intravascular Contrast Extravasation



Urinary Extravasation

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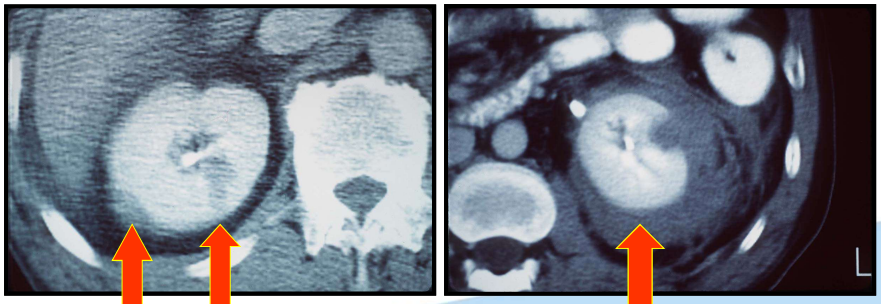
Grade 1 & Grade 2 Injury: Observation



Contusion

Perinephric hematoma

Subcapsular hematoma

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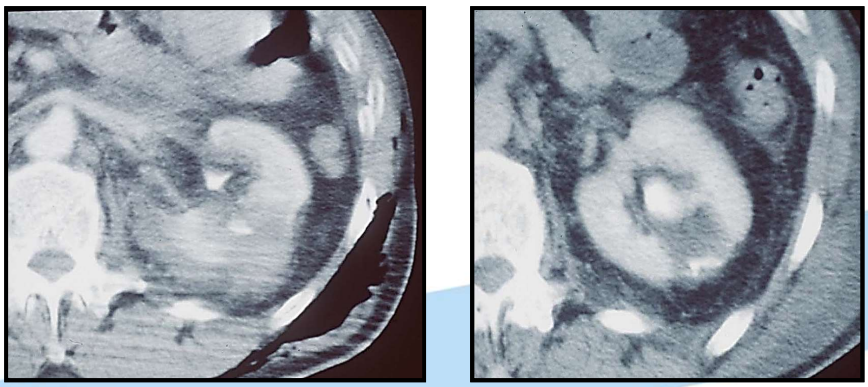
Blunt Grade 3 Injury: Observe



> 1 cm

1 week later

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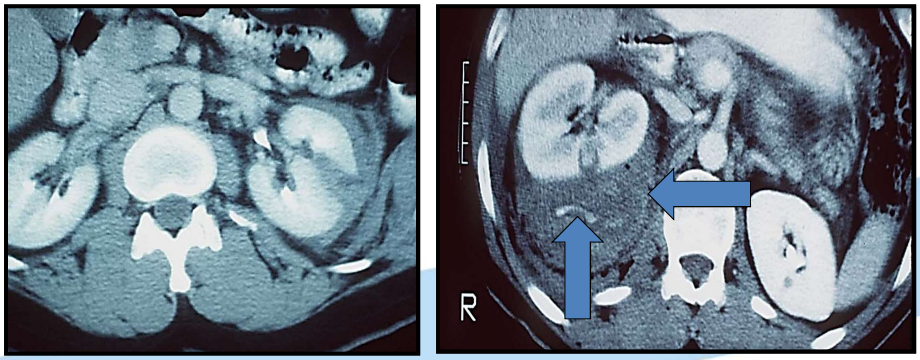
Grade 4 Lacerations More Variable

(And thus more likely "Testable"…)



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Trauma/Reconstruction/Diversion

American Association for the Surgery of Trauma Grade 4 Renal Injury Substratification Into Grades 4a (Low Risk) and 4b (High Risk)

Daniel D. Dugi, III, Allen F. Morey, Amit Gupta, Geoffrey R. Nuss, Geraldine L. Sheu and Jeffrey H. Pruitt

From the Departments of Urology and Radiology (JHP), University of Texas Southwestern Medical Center, Dallas, Texas

3 Risk Factors:

1. Perineal hematoma ≥ 3.5cm
2. Complex/medial laceration
3. Intravascular Contrast Extravasation (ICE)

Low risk: 0 or 1 risk factor

High risk: ≥ 2 risk factors

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Dugi et al, J Urology 2010.

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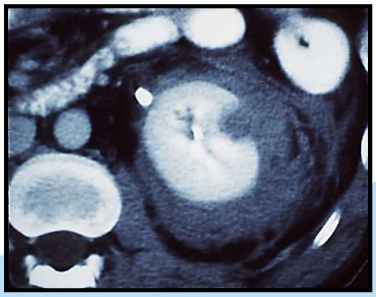
Renal Trauma Management

4. **Should** use non-invasive management if hemodynamically stable (***Standard, Grade B***)



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Renal

5. Must perform <u>immediate intervention</u> (surgery or angioembolization in selected situations) in <u>hemodynamically unstable</u> patients with no or transient response to resuscitation. **(Standard; Evidence Strength: Grade B)**

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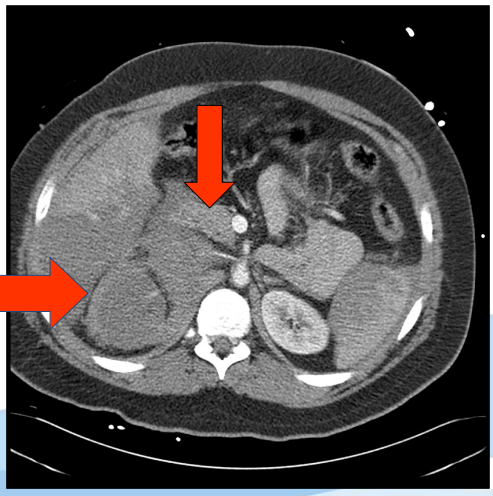
What Is Your Diagnosis?
(Hint: MVA, Deceleration Injury)

Assess the clues:

See Renal Hilum

Right Kidney Lacks Arterial Inflow



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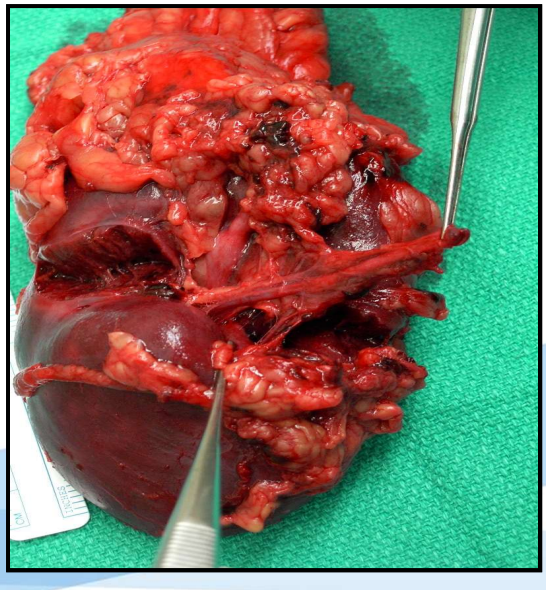
Renal Pedicle Avulsion



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Is Follow-up Renal Imaging Necessary?

7. …Perform follow-up CT imaging for renal trauma patients having either

(a) Deep lacerations (AAST Grade IV-V)

(b) Clinical signs of complications

(i.e. fever, worsening flank pain, ongoing blood loss, abdominal distention)

(Recommendation; Evidence Strength: Grade C)

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Grade 3 Renal Injury after MVA

Perinephric hematoma + <u>No</u> extrav. on delayed images

Treatment?

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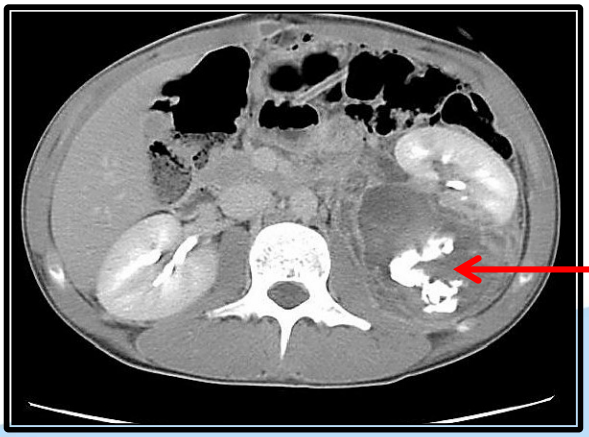
Follow Up CT at 72 Hrs for Fever



SIU Consensus Panel, BJU Intl 2004;94

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Interventions for Renal Injury Complications

8. "Perform urinary drainage in the presence of complications such as:
   - enlarging urinoma, fever
   - increasing pain
   - ileus, urinary fistula or infection"

(Recommendation; Evidence Strength: Grade C)

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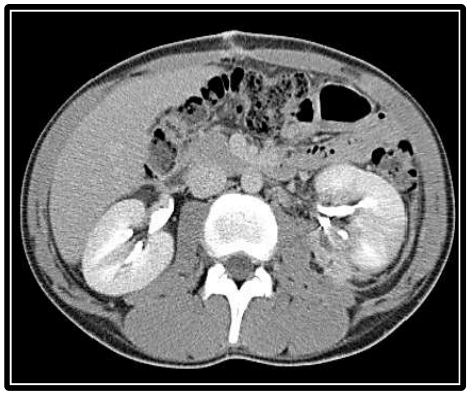
Post Embolization: Stent, Foley, Drain



1 Month Later

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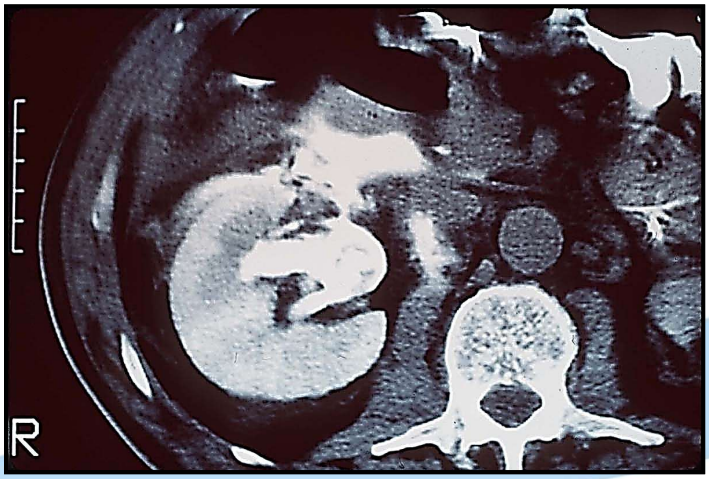
Urinary Extravasation: Usually Safely Observed – but Needs to Resolve!



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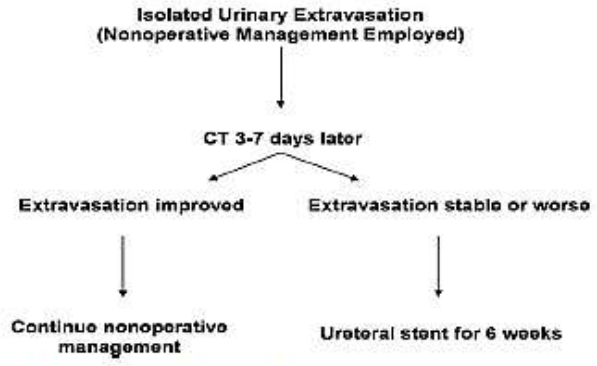
Trauma/Reconstruction/Diversion

Nonoperative Management Outcomes of Isolated Urinary Extravasation Following Renal Lacerations Due to External Trauma

Nejd F. Alsikafi,* Jack W. McAninch,† Sean P. Elliott and Maurice Garcia

From the Department of Urology, Mount Sinai Medical Center and University of Chicago Medical Center, Chicago, Illinois, and San Francisco General Hospital and University of California, San Francisco, San Francisco, California



10%

FIG. 1. Management algorithm for isolated urinary extravasation following renal trauma.

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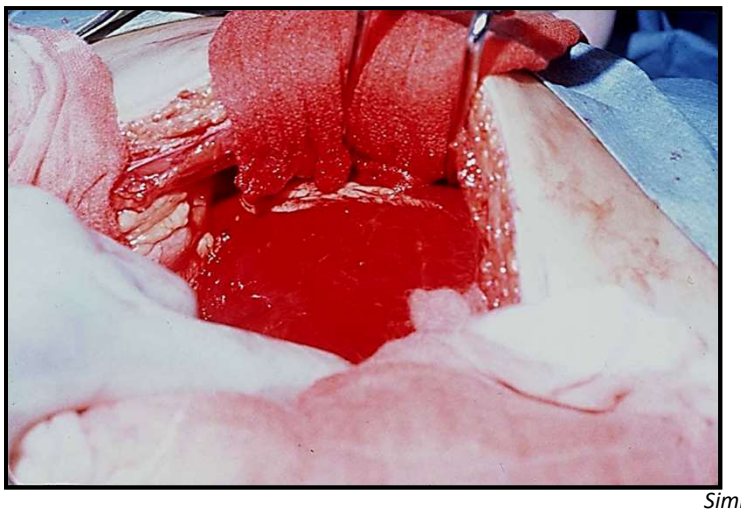
Vol. 176, 2494-2497, December 2006

Intraoperative Consult: Retroperitoneal Hematoma?



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Indications for Renal Exploration

Absolute	Relative
• Hemodynamic instability • **Expanding pulsatile** hematoma • Major injury solitary kidney	• Non-viable tissue • **Persistent** Urinary extravasation • Renal artery • Surgery for associated injury

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IntraOp One Shot IVP

- Bolus injection of contrast 2cc/kg
- Plain film after 10 minutes
- Confirms presence of contralateral kidney
- May have to wait longer longer for hypotensive patient. (Spiral CT problem)

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Question 1

A 27M sustains a trans-abdominal GSW and is taken to the OR by the Trauma Surgery service. Intraoperatively, a non-expanding hematoma is noted in the L retroperitoneum along with several bowel injuries. From a urologic standpoint, you recommend:

A. Observation
B. Renal exploration with repair
C. Ureteral exploration with repair
D. Nephrectomy

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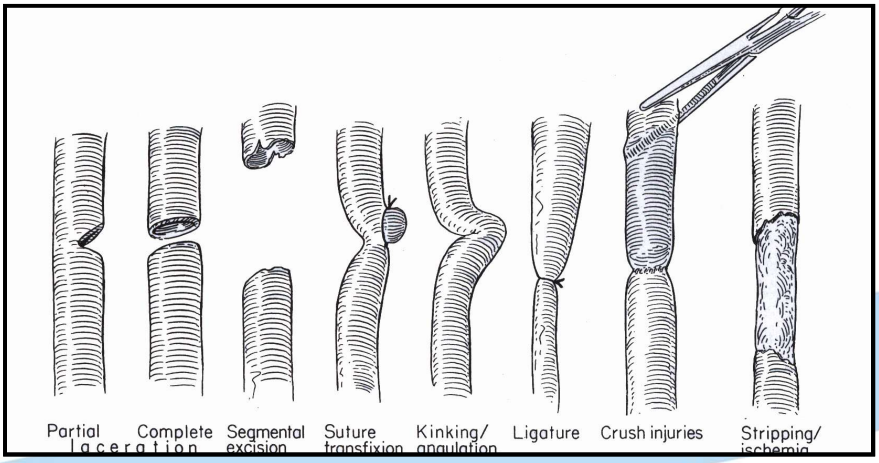
Many Ureteral Traumas are Latrogenic



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Ureteral Trauma Imaging

Clinicians should perform IV contrast enhanced abdominal/pelvic CT with delayed imaging (urogram) for stable trauma patients with suspected ureteral injuries. **(Recommendation; Evidence Strength: Grade C)**

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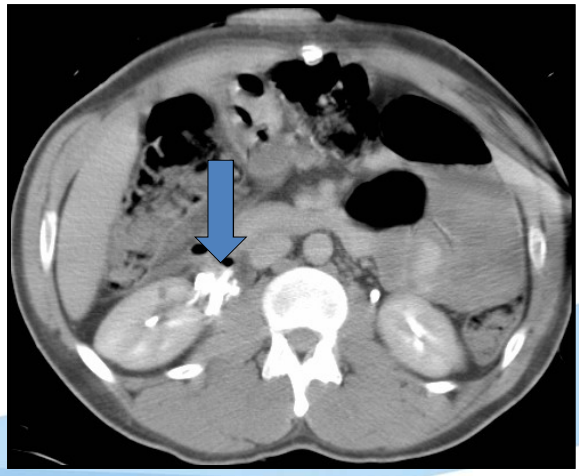
CT More Sensitive Than IVP: Should Include 10 Minute View



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J Urol 2003, 170:1213 (SFGH)

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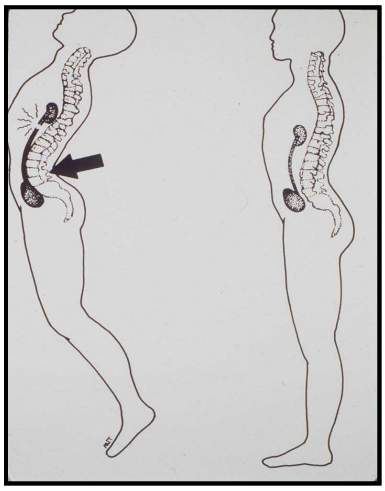
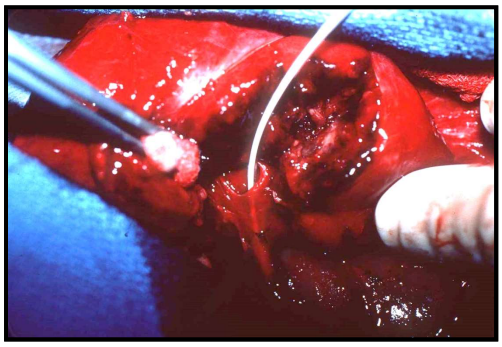
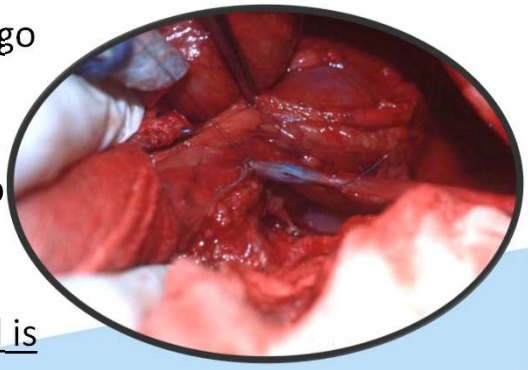
UPJ Disruption – Usually in Peds and Rapid Deceleration Event





Ureteral Injury Diagnosis: Surgical Exploration

- IV or intra-ureter indigo
- Contused or bruised ureter
- Wall discoloration, no capillary refill, no bleeding edge
- <u>Most reliable method is direct inspection</u>



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Ureter

9b. "…Directly inspect the ureters during laparotomy in patients with suspected ureteral injury who have not had preoperative imaging" **(Clinical Principle)**

- Direct exploration is the "best" method to diagnose intraoperative ureteral injury
- Best imaging study = Retrograde pyelogram

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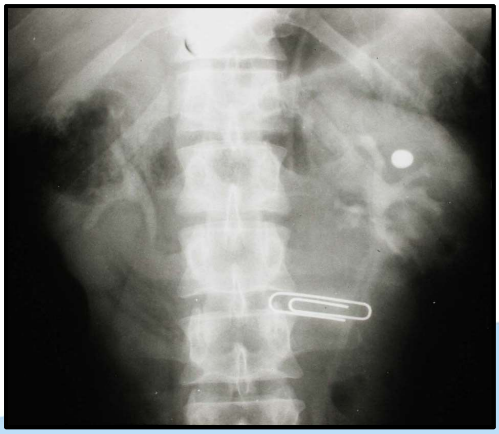
False Negative IVP

IVP is a notoriously poor study to diagnose traumatic ureteral injury



LUQ GSW→ > 50% Ureteral Transection

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Ureteral Stent for Traumatic Injury

11a. Surgeons **should** attempt ureteral stent placement in patients with incomplete ureteral injuries diagnosed postoperatively or in a delayed setting.
(Recommendation; Evidence Strength: Grade C)

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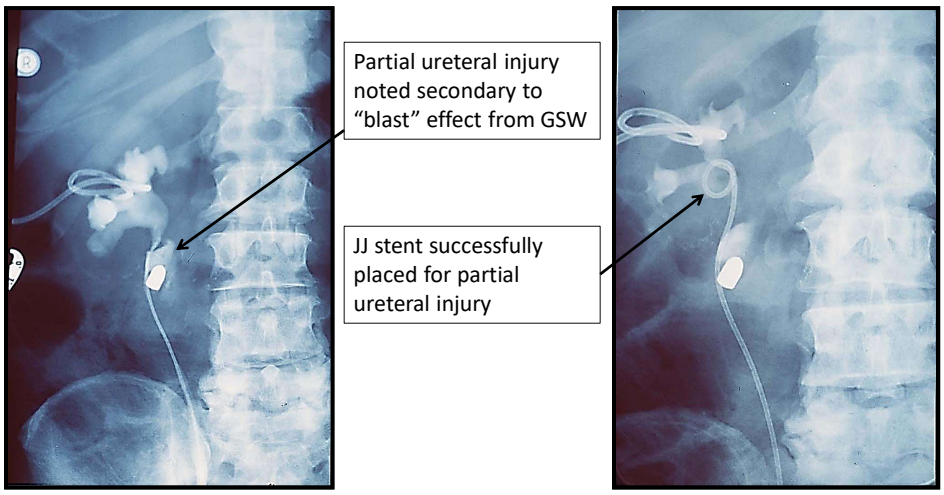
Endoscopic Management



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Ureteral Contusion

10c. "Surgeons should manage traumatic ureteral contusions at the time of laparotomy with ureteral stenting or resection and primary repair (EPA) depending on ureteral viability and clinical scenario".

(Expert Opinion)

- Stent OK if low-velocity GSW
- Resect and repair if contusion severe

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Timing of Ureteral Repair: When Is Injury Recognized?

- Intraoperative
  - Immediate repair preferred
- < 5 days & stable
  - Retrograde pyelogram + Stent preferred
  - Immediate repair OK if complex
- 5 or more days—complications more likely
  - Stent or nephrostomy
  - Drain urinoma
  - Delayed reconstruction

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Ureteral Fistulae: T or F?

Ureteral fistulae (ureterovaginal and uretero-uterine) often close spontaneously after stent placement alone.

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Ureteral Fistulae: True

11c. Clinicians may initially manage patients with ureterovaginal fistula using stent placement. In the event of stent failure, clinicians may pursue additional surgical intervention

Br J Urol 1993:65:453

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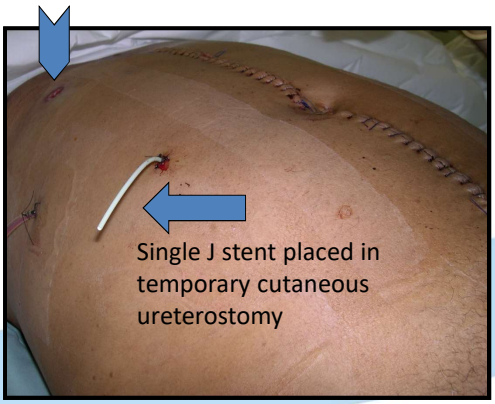
Ureteral Injury: Damage Control

- Single J stent diversion (distal suture)
- Ligation + PCN, delayed reconstruction



J Urol 2005:1202-1205

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PCN for Ureteral Injury

11b. Surgeons should perform percutaneous nephrostomy with delayed repair as needed in patients when stent placement is unsuccessful or not possible.
(Recommendation; Evidence Strength: Grade C)

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Principles of Ureteral Repair

- Debride non-viable tissue
- Wide spatulation
- Tension-free
- Watertight closure
- Stent
- Peri-ureteral drainage (+/-)

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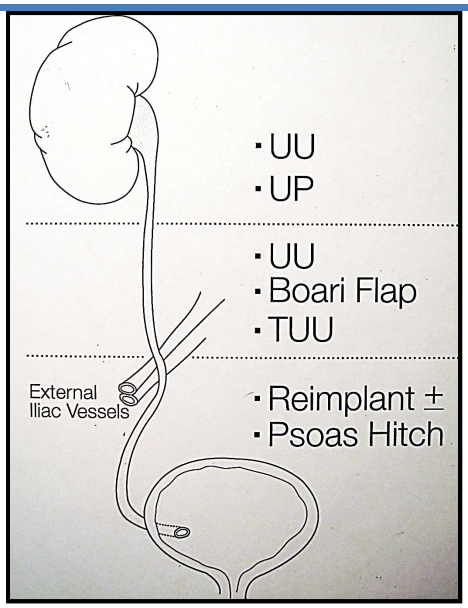
Involved Ureteral Segments



Repair Type by Injury Location

TUU usually exam distractor; Not the answer

Following slides represent index cases with examples

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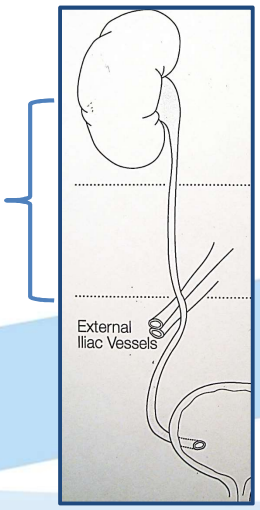
Ureteral

12a. "…Repair ureteral injuries located <u>proximal</u> to the iliac vessels with <u>primary repair</u> [U-U] over a ureteral stent, when possible".

(Recommendation; Evidence Strength: Grade C)



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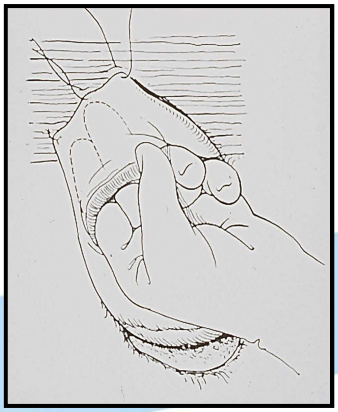
Ureteral Reconstruction Cases



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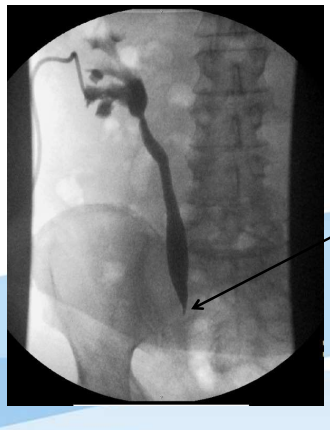
Psoas Hitch

58M, history of right mid-distal stricture after history of multiple stone related endoscopic procedures



Note antegrade contrast administration terminates at the level of the iliac vessels

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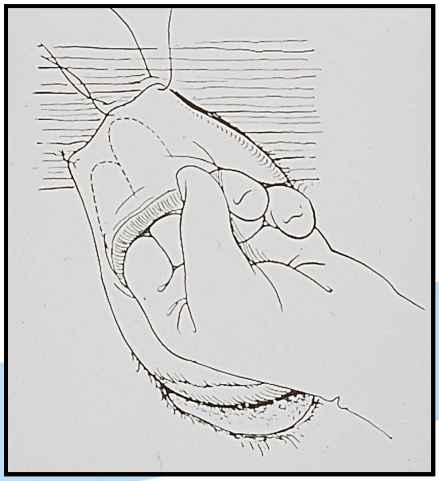
Psoas Hitch Ureteroneocystostomy

- Highly reliable: 85+% long-term success
- Iatrogenic, traumatic inj
- Caution
  - **Genitofemoral nerve**
  - **Femoral nerve (deep)**



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Pearls of Psoas Hitch Reimplant

- Mobilize contralateral superior bladder
- Hitch bladder prior to reimplantation – straight ureteral tunnel with 2 to 4 sutures (absorbable)
- Refluxing, spatulated anastomosis, stent

Marshall, J Urol, 1997

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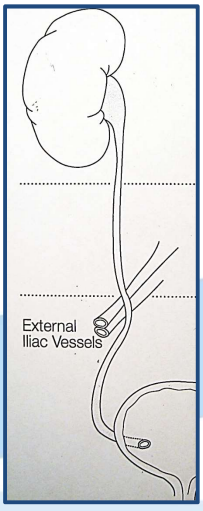
Ureter

12b. "…Repair ureteral injuries located distal to the iliac vessels with ureteral reimplantation or primary repair over a ureteral stent, when possible".

(Recommendation; Evidence Strength: Grade C)



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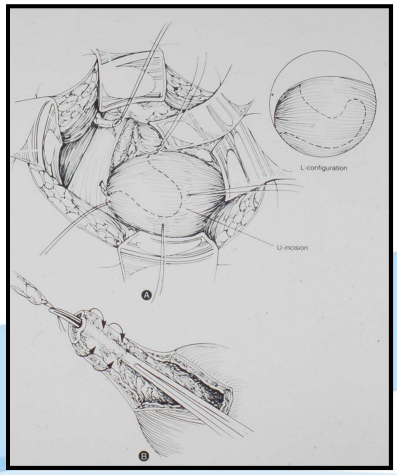
Boari Flap Reimplant

- Lower 2/3 (L4-5)
- May compromise bladder volume
- Tubularization difficult if detrusor hypertrophied
- Not too narrow (flap necrosis)
- Planned, delayed repair best



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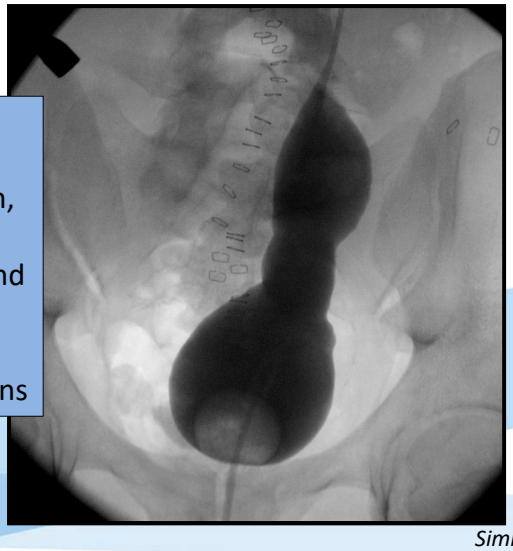
How High Can a Boari Go?

Prior to extensive mobilization of bladder and Boari reconstruction, adequate capacity(>300 cc) should be ensured and patients ought to be counseled on possible change in voiding patterns



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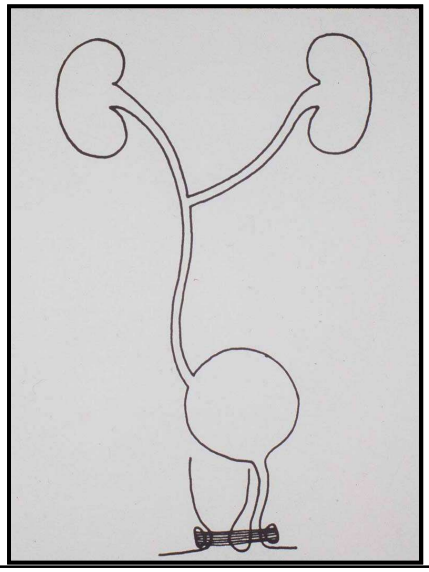
Transureteroureterostomy



- 96% effective in 25 yr Mayo experience (n=63)
- Complications higher for malignant (47%) vs benign (11%), p=0.04
- Above IMA
- End-to-side over stent
- Yo-yo effect→hydro

Iwaszko MR et al. J Urol 2010;183

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Transureteroureterostomy

Indications:

- Planned, Delayed
- Bladder small, fibrotic, pelvic abscess
- Extensive lower ureteral defect

Contraindications:

- Pelvic radiation
- Reflux
- Stone disease
- Cancer, TB, RPF

OFTEN UTILIZED AS A DISTRACTOR ON EXAMINATIONS!

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30F with a History of Failed Robotic Pyeloplasty x2

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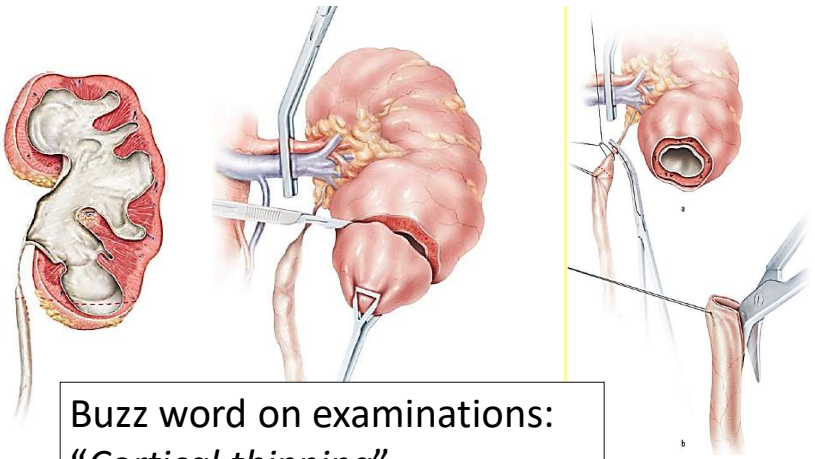
Ureterocalycostomy



Buzz word on examinations:
"*Cortical thinning*"

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42F
Remote h/o TB. Solitary kidney

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Ileal Ureter → Extensive Defects

- 80+% successful
- Contraindicated if renal compromise
- Risks: infection, mucus, fistula, stone
- Consider: autotransplant, nephrectomy, appendix

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Ureteroscopic Perforations

13a. "..Manage endoscopic ureteral injuries with a ureteral stent and/or percutaneous nephrostomy tube, when possible".

(Recommendation; Evidence Strength: Grade C)

13b. "…Manage endoscopic ureteral injuries with open repair when endoscopic or percutaneous procedures are not possible or fail to adequately divert the urine".

(Expert Opinion)

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Question 2

A 49F undergoing elective ureteroscopy for nephrolithiasis sustains a ureteral avulsion that begins 3 cm below the UPJ and progresses to the ureteral orifice. She undergoes PCN placement and presents for elective repair. You recommend:

A. Psoas Hitch
B. Transureteroureterostomy
C. Ileal Ureter
D. Nephrectomy

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Lower Abdominal Trauma

- 34 y/o no significant PMH
- Bar fight 2 days ago. “Kicked multiple times”
- Presents to ER with abd. pain, low urine output and gross hematuria
- PE
  - Diffuse abd. tenderness, worse in SP area
  - UA - Gross hematuria
  - BMP - Na 149, K 5.6, CO2 17, BUN 35

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Bladder

14b. “ Perform retrograde cystography in stable patients with gross hematuria and a mechanism concerning for bladder injury, or in those with pelvic ring fractures and clinical indicators of bladder rupture”.

(Recommendation; Evidence Strength: Grade C)

- Retrograde Fill to 350ml or till capacity
- Clamping Foley during CT Scan is not adequate

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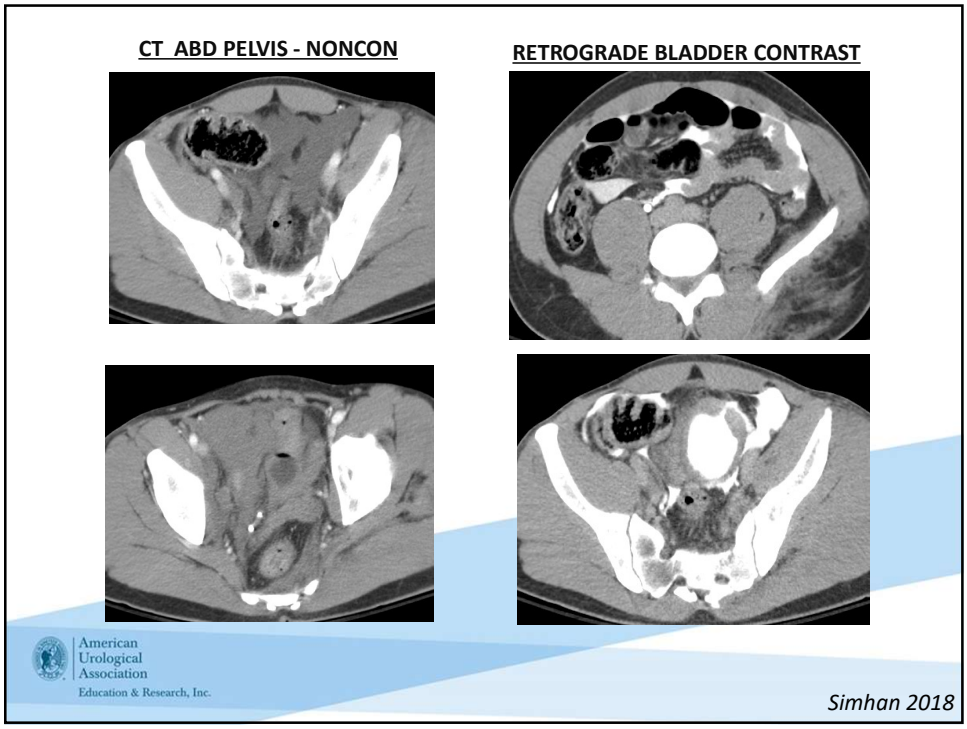
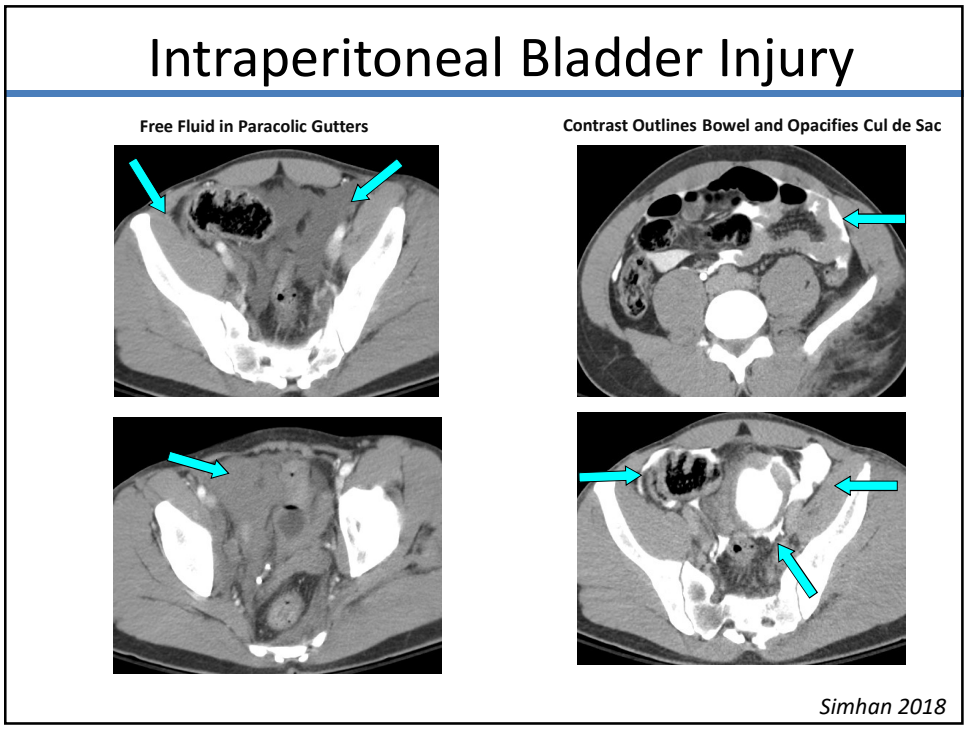
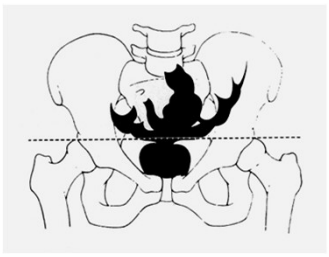
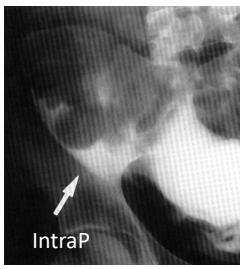




Plain Film Cystography: IntraP Injury





Intraperitoneal Contrast

- Outlines loops of bowel
- Fills Cul-de-Sac (Pouch of Douglas)
- Fills Paracolic Gutters
- Usually Above Superior Acetabular Line

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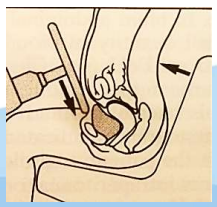
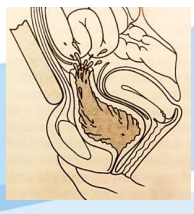
Bladder

15." Surgeons must perform surgical repair of intraperitoneal bladder rupture in the setting of blunt or penetrating external trauma".

(Standard; Evidence Strength: Grade B)

- Blunt bladder injuries to the dome – mean 6 cm





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Bladder

18. "Clinicians should perform urethral catheter drainage **without** **suprapubic** (SP) cystostomy in patients following surgical repair of bladder injuries.

(Standard; Evidence Strength: Grade B)

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Pelvic Fracture Case

- 36 yo , no PMH
- MVA – restrained driver
- Pelvic and leg pain
- X-rays – Pelvic FX
- X-rays – R femur FX
- Foley placed easily – gross hematuria

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Indications for Imaging?

- Pelvic Fracture + Gross Hematuria
  - –82/285 (29%)
- Pelvic Fracture + Microhematuria
  - –3/503 (0.6%)

J Trauma 2001:51;683

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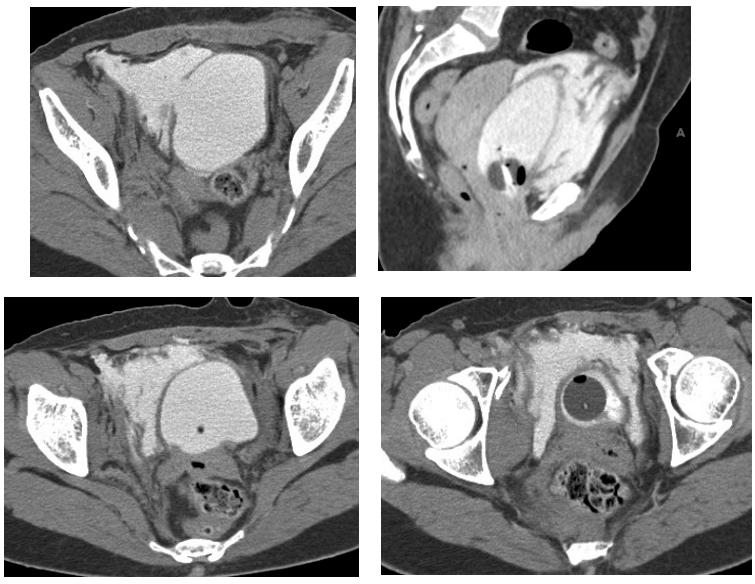
CT Cystogram



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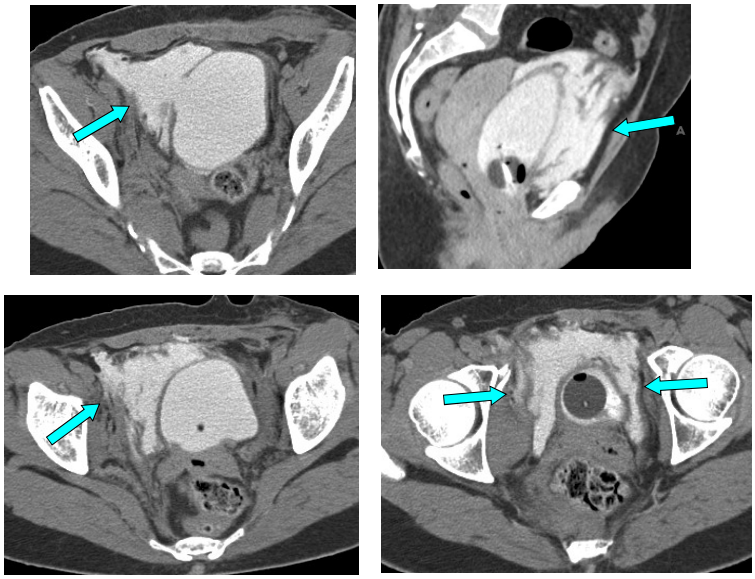
Extraperitoneal Injury



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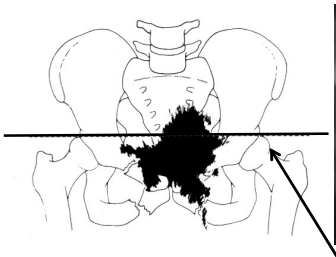
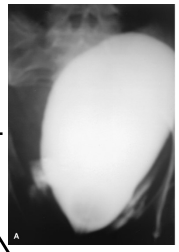
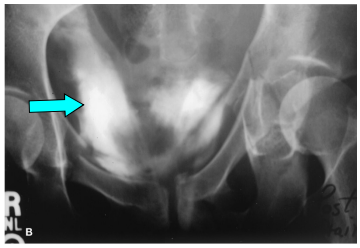
Plain Film Cystogram: ExtraP Injury







Extravasation on delayed films

– Flame-Like
– Star-Burst
– Usually Below Superior Acetabular Line

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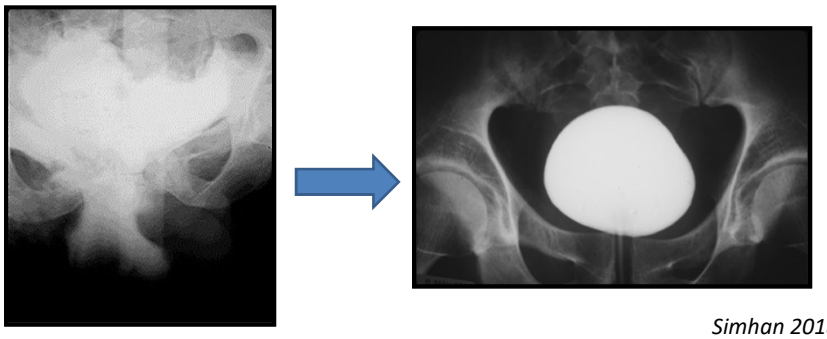
Extraperitoneal Bladder Rupture

16. Catheter drainage as treatment for patients with ***uncomplicated*** extraperitoneal bladder injuries. **(Recommendation; Evidence Strength: Grade C)**



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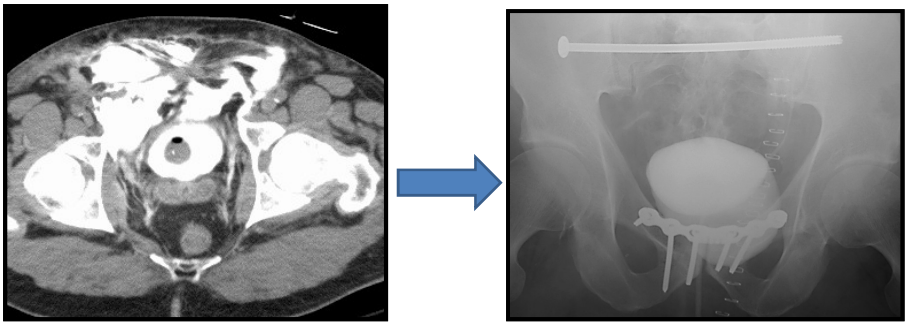
Complicated Bladder Trauma

Should perform surgical repair in patients with complicated extraperitoneal bladder injury. **(Recommendation; Evidence Strength: Grade C)**



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So… What's "Complicated?"

- Vaginal laceration
- Bladder neck injury
- Persistent gross hematuria w clots
- Concomitant rectal injury
- Bone fragment/foreign body in bladder (e.g. from pelvis) – rare
- Undergoing exploration for another injury (orthopedic or abdominal)

Lucas and Simhan, Curr Trauma, 2017

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- 46 yo
- Penis slipped out vagina during intercourse
- Immediate pain and penis swelling
- Immediate detumescence
- Presents to ER 6 hrs after injury at 2 AM

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Genital

26. Clinicians **must** suspect penile fracture when a patient presents with penile ecchymosis, swelling, cracking or snapping sound during intercourse or manipulation and immediate detumescence. **(Standard; Evidence Strength: Grade B)**

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However, what if...

- Penis slipped out vagina during intercourse
- "Mild" pain
- "Mild" bruising
- "Unsure if rapid detumescence"

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Penis

28. “Clinicians may perform ultrasound in patients with equivocal signs and symptoms of penile fracture”. **(Expert Opinion)**

- US – most commonly used and wide availability
- MR for equivocal US
- Equivocal imaging → Exploration

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Coming back to this case…

How is the urethra evaluated?

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Penile FX and Urethral Inj

29. "Clinicians must perform evaluation for concomitant urethral injury in patients with penile fracture or penetrating trauma who present with:

    - blood at the urethral meatus

    - gross hematuria

    - inability to void.

    (Standard; Evidence Strength: Grade B)

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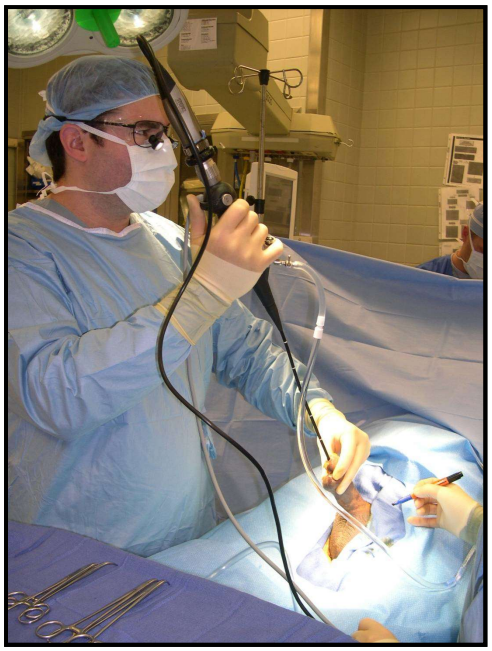

- Cystoscopy is one way to perform an "on table" OR evaluation
- Other ways include a Retrograde Urethrogram either preop or intraop

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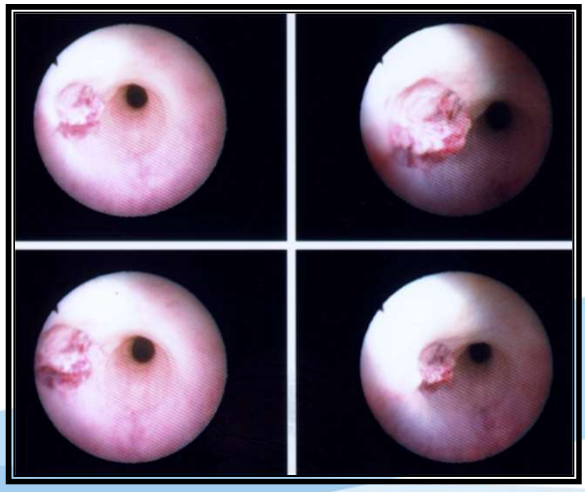
Penile Fracture



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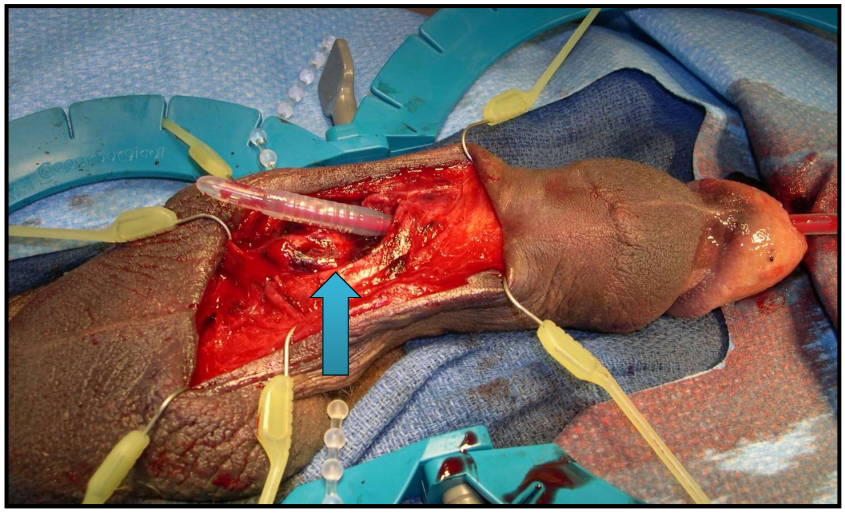
Complete Urethral Rupture & Fracture of Both Corpora



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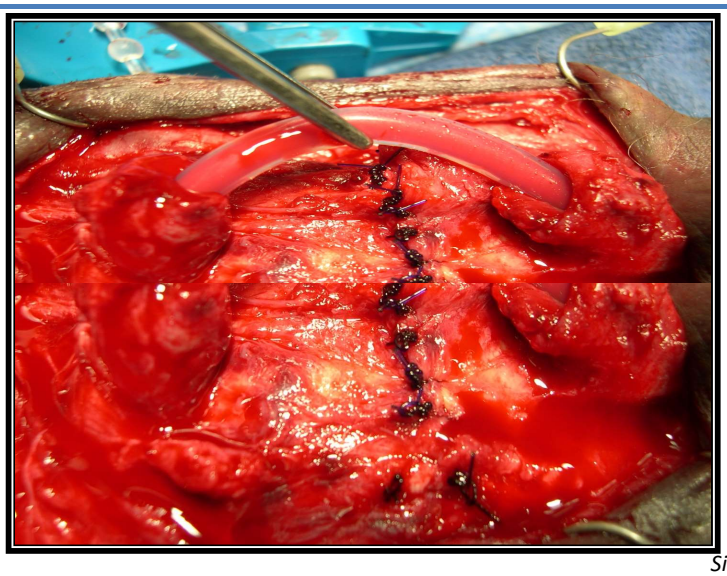
Corpora Repaired



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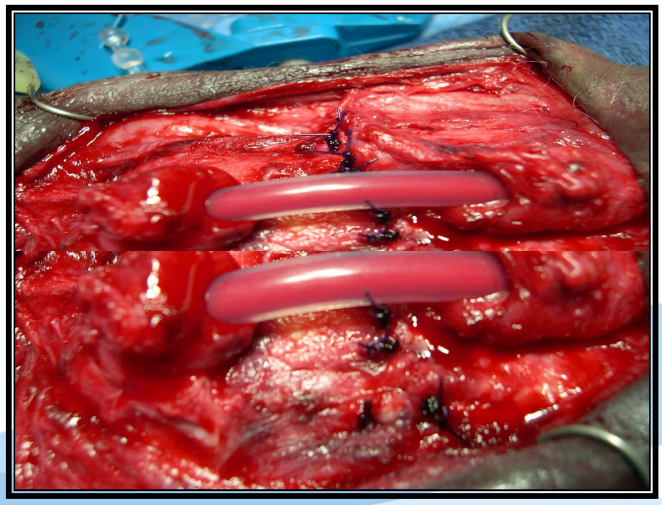
3 cm Urethral Defect

?



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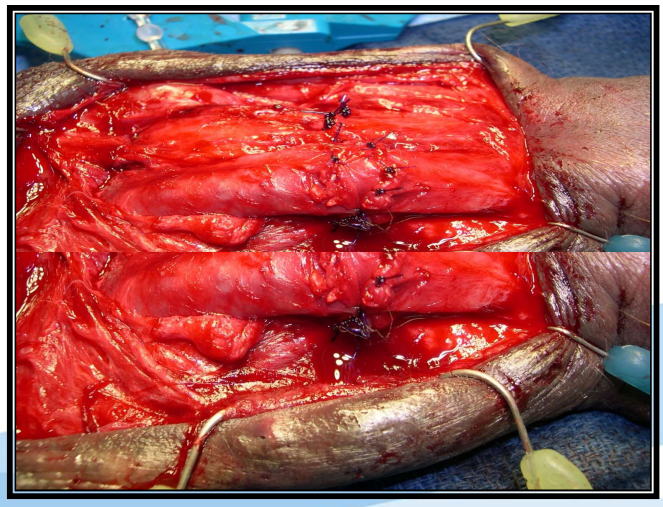
Urethra Mobilized & Repaired



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Genital

27. "Surgeons should perform <u>prompt</u> surgical exploration and repair in patients with acute signs and symptoms of penile fracture". **(Standard; Evidence Strength: Grade B)**

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Male Sexual Dysfunction

UROLOGY 77 (6), 2011

Does Timing of Presentation of Penile Fracture Affect Outcome of Surgical Intervention?

Ahmed El-Assmy, Hossam S. El-Tholoth, Tarek Mohsen, and El Housseiny I. Ibrahiem

- 180 patients: 1986-2010
- Divided into two study groups
  - Group I: **"Early"** presentation, <24 hours
    - F/u 105 months
  - Group II: **"Delayed"** presentation, >24 hours
    - F/u 113 months

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Timing of Repair – No Difference

- After long-term f/u, NO difference in complications b/w groups
- Bottom line: prompt repair should be done (but does not need to be treated as "surgical emergency")

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El-Assmy et al, Urology, 2011

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Question 3

A 43M presents to his urologist's office four days after having painful sex. He is uncertain as to whether he experienced rapid detumescence. Exam demonstrates mild bruising and pain to palpation. Urinalysis demonstrates 5 RBCs. The next step is:

A. Observation
B. Penile Ultrasound
C. Penile MRI
D. Flexible cystoscopy
E. Penile Fracture Repair

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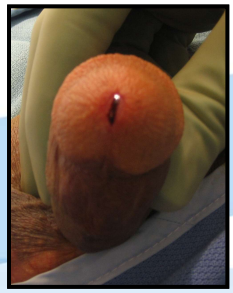
Urethral Trauma

- Mechanism of Injury
  - Shear/ distraction (pelvic fracture urethral injury-PFUI)
  - Penetrating trauma
  - Penile fracture
- Signs and Symptoms
  - **blood at the urethral meatus**
  - difficulty/inability to void
  - palpable bladder distension
  - butterfly hematoma
  - high-riding prostate
  - fracture of the pubic rami



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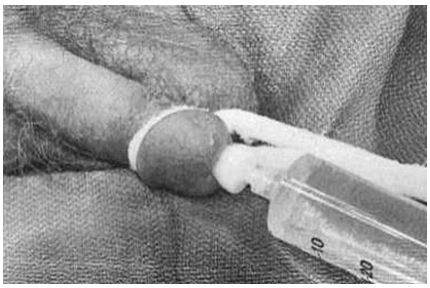
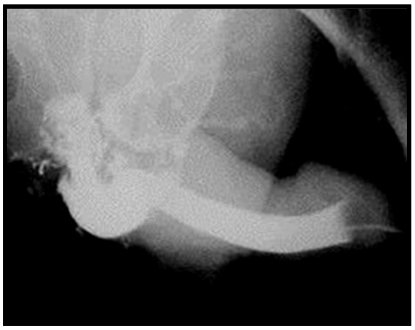
Urethral Trauma Imaging

19. **Should** perform retrograde urethrography in patients with blood at the urethral meatus after pelvic trauma. **(Recommendation; Evidence Strength: Grade C)**





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Posterior Urethral Disruption: "The Controversy"

- Immediate primary repair? - NEVER
- Endoscopic realignment?
- Suprapubic tube + delayed reconstruction?

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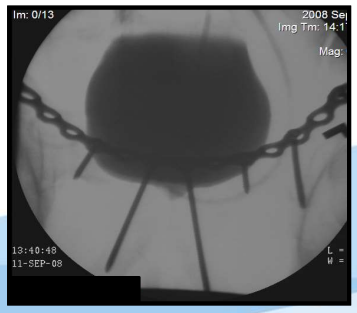
Pelvic Fracture Urethral Injury

21. **May** place SP in patients undergoing open reduction internal fixation (ORIF) for pelvic fracture. **(Expert Opinion)**



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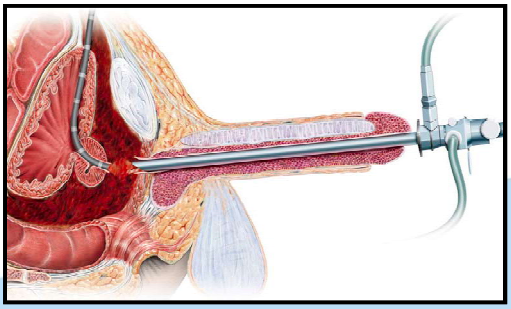
Urethral Trauma Management

22. **May** perform primary realignment (PR) in **hemodynamically stable patients** with pelvic fracture associated urethral injury. **(Option; Evidence Strength: Grade C)**



should not perform prolonged attempts…

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The Journal of Urology

Urethral Reconstruction for Traumatic Posterior Urethral Disruption: Outcomes of a 25-Year Experience

Matthew R. Cooperberg,* Jack W. McAninch†, Nejd F. Alsikafi and Sean P. Elliott

From the Departments of Urology, University of California, San Francisco, San Francisco, California (MRC, JWM), Loyola University, Maywood, Illinois (NFA), and University of Minnesota, Minneapolis, Minnesota (SPE)

- 134 delayed posterior urethroplasty after trauma
- 115 (84%) -- no additional procedures
- 124 (93%) -- ≤1 VIU

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J Urol 2007

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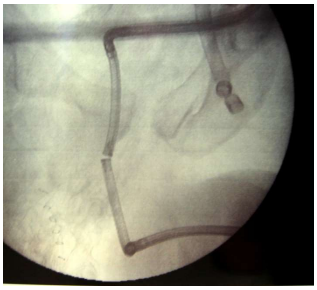
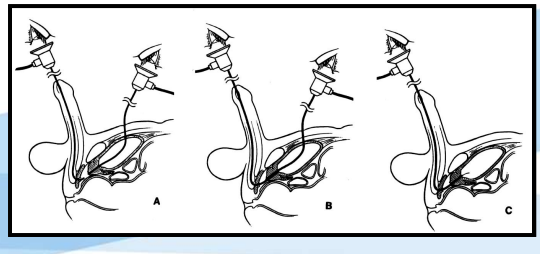
Primary Realignment





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Urethra

23. “Clinicians should monitor patients for complications (e.g., stricture formation, erectile dysfunction, incontinence) for at least one year following urethral injury”.

(Recommendation; Evidence Strength: Grade C)

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Question 4

An 18M falls and sustains a pelvic fracture. He presents to the ER with blood at the urethral meatus, abdominal pain, tachycardia, and hypotension. In this setting, which option is the best urologic management?

A. Observation
B. One pass Foley attempt
C. Suprapubic tube placement
D. Operative primary realignment

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Blunt Scrotal Trauma

- 27 year old
- Struck in scrotum by golf ball - line drive
- Swollen and red scrotum, tender to palp
- UA: no RBC

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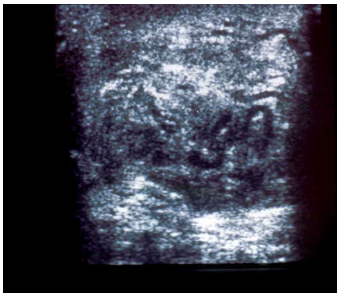
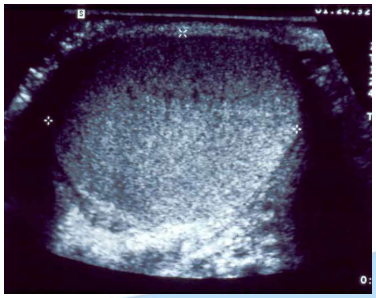
Ultrasound Echo Pattern



Heterogeneous echo pattern – Suggests rupture

<u>Proceed to OR</u>



Normal homogenous contralateral testis

Buckley and McAninch, J Urol 2006

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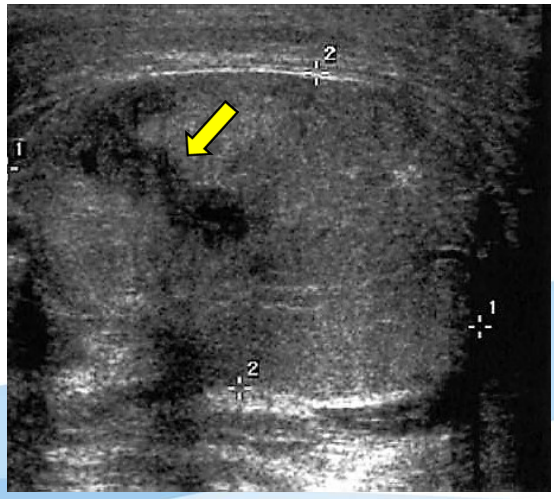
Scrotal Ultrasound for Penetrating Trauma



Buckley and McAninch, J Urol 2006

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GSW Scrotum

- Physical Exam often unreliable with penetrating scrotal injuries
- Scrotal GSW that penetrate the Dartos or present with scrotal swelling should be explored.

Simhan J, BJUI, 2012

Simhan 2018

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Question 5

A 32M sustains scrotal trauma after a bar fight. Ultrasound reveals bilateral heterogeneous echogenicity. The best management is:

A. Observation
B. Operative exploration with bilateral testicular repair and testicular fixation
C. Operative exploration with bilateral testicular repair without testicular fixation
D. Operative exploration with bilateral orchiectomy

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Conclusions

- Organ salvage increasingly achievable
- Multi-disciplinary evidence-based approach
- Timely interventions
- Interface with diagnostic and interventional radiology, trauma and orthopedic surgeons, plastic and reconstructive surgery

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