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030IC - Urotrauma: Guidelines, Controversies, and Challenging Cases

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Urotrauma: Guidelines, Controversies, and Challenging Cases

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RENAL TRAUMA

Renal Trauma

Diagnosis

1. Clinicians should perform diagnostic imaging with intravenous (IV) contrast enhanced computed tomography (CT) in stable *blunt* trauma patients with gross hematuria or microscopic hematuria and systolic blood pressure < 90mmHG.

Renal Trauma

Diagnosis

2. Clinicians should perform diagnostic imaging with IV contrast enhanced CT in stable trauma patients with mechanism of injury or physical exam findings concerning for renal injury (e.g., rapid deceleration, significant blow to flank, rib fracture, significant flank ecchymosis, penetrating injury of abdomen, flank, or lower chest).

Renal Trauma

Diagnosis

3. Clinicians should perform IV contrast enhanced abdominal/pelvic CT with immediate and delayed images when there is suspicion of renal injury.

Renal Trauma

Management

4. Clinicians should use non-invasive management strategies in hemodynamically stable patients with renal injury.

ICU admission
Hemodynamic monitoring
Bed rest?
Blood transfusion

Renal Trauma

Management

5. The surgical team must perform immediate intervention (surgery or angioembolization in selected situations) in hemodynamically *unstable* patients with no or transient response to resuscitation.

Traditional Indications for Renal Exploration

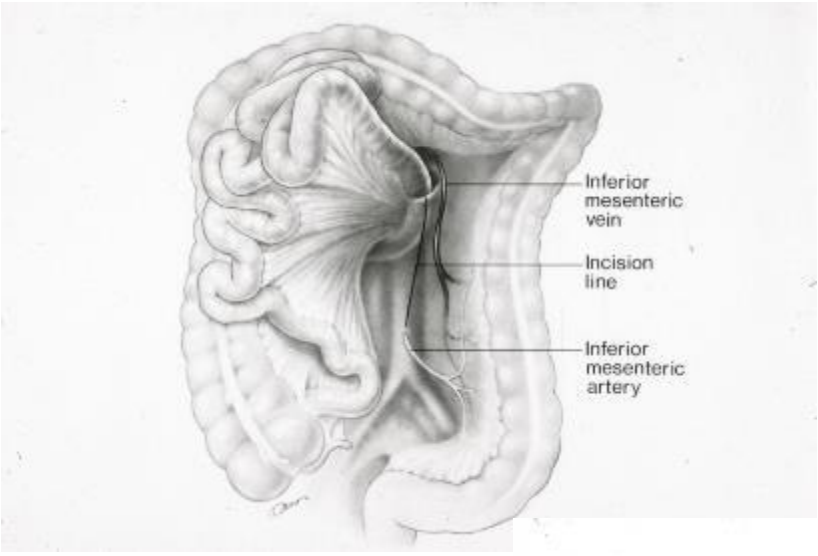
Absolute

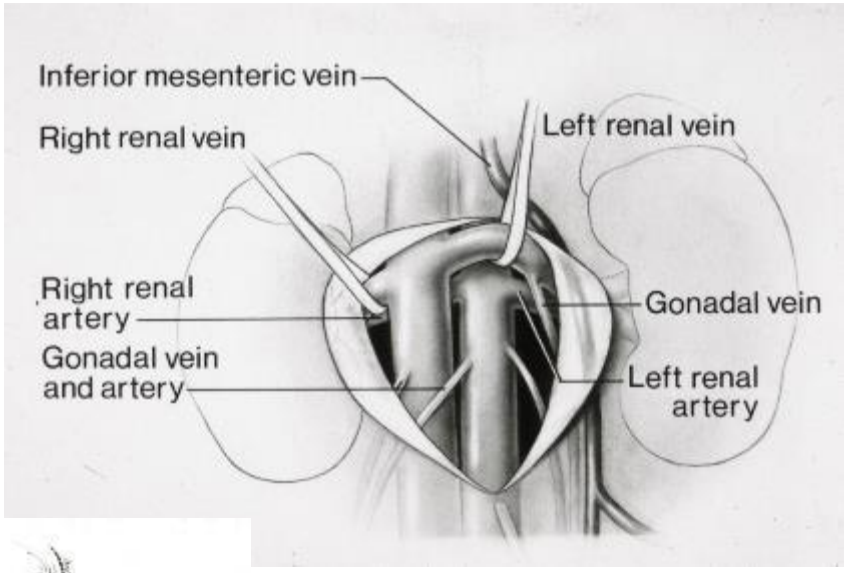
- Hemodynamic instability from renal hemorrhage suggested by an expanding or pulsatile retroperitoneal hematoma

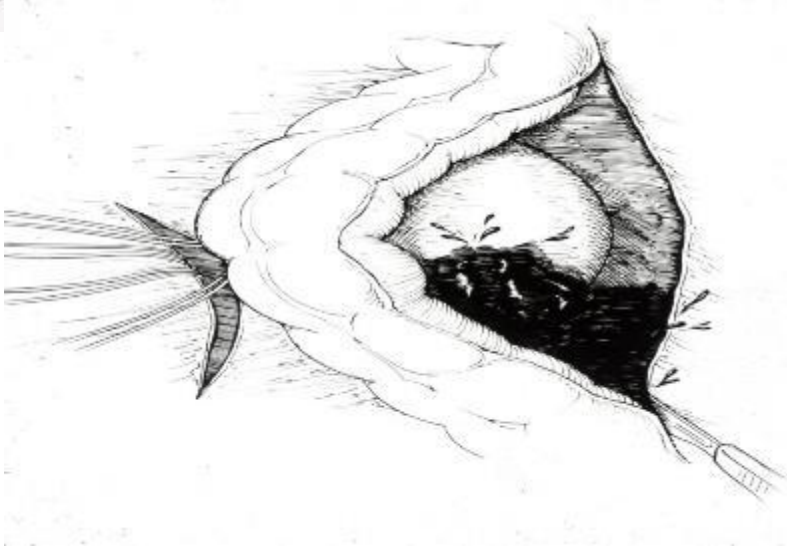
(cont.) Traditional Indications for Renal Exploration

Relative

- Urinary extravasation: especially from the renal pelvis
- Non-viable parenchyma: >25%
- Renovascular injury
- Persistent bleeding: >2 units PRBCs
- Incomplete radiographic staging
- Laparotomy required for associated injury: especially with bowel or pancreatic injury

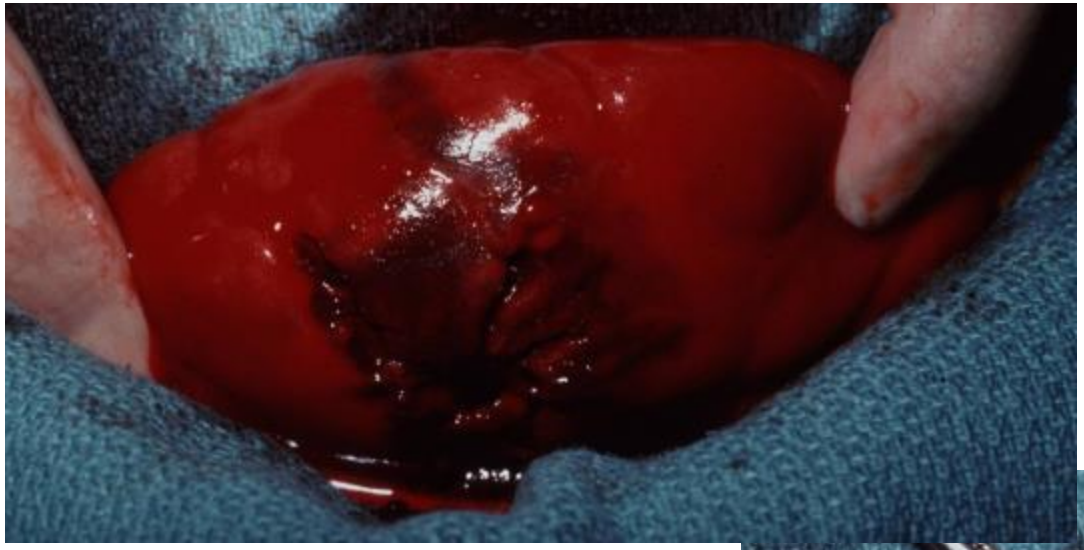

Inferior mesenteric vein
Incision line
Inferior mesenteric artery

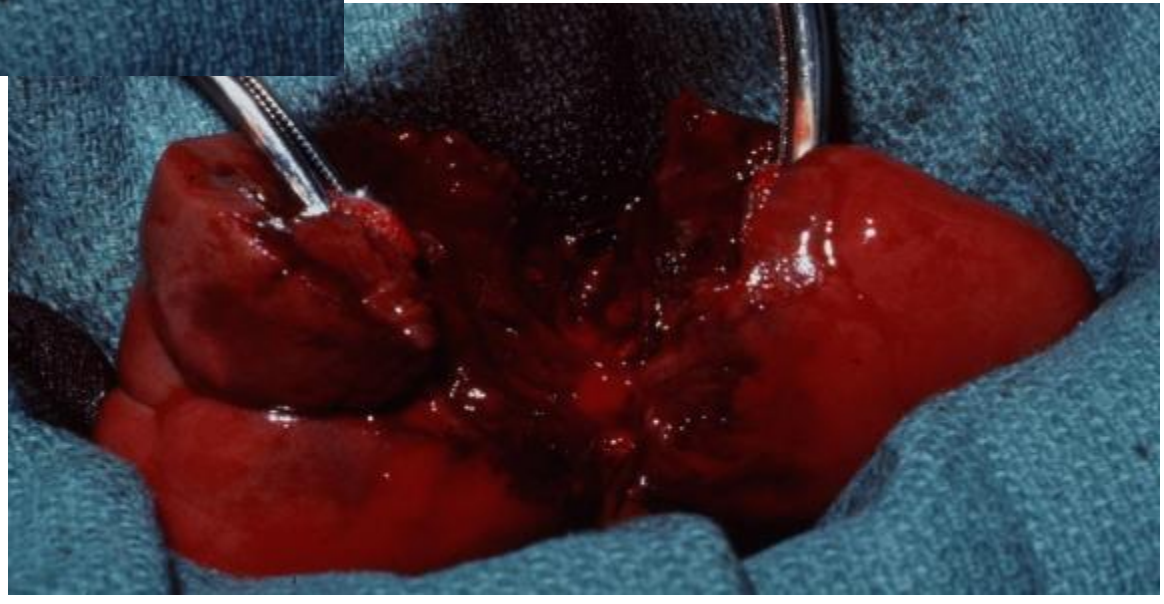

Inferior mesenteric vein
Right renal vein
Left renal vein
Right renal artery
Gonadal vein
Gonadal vein and artery
Left renal artery

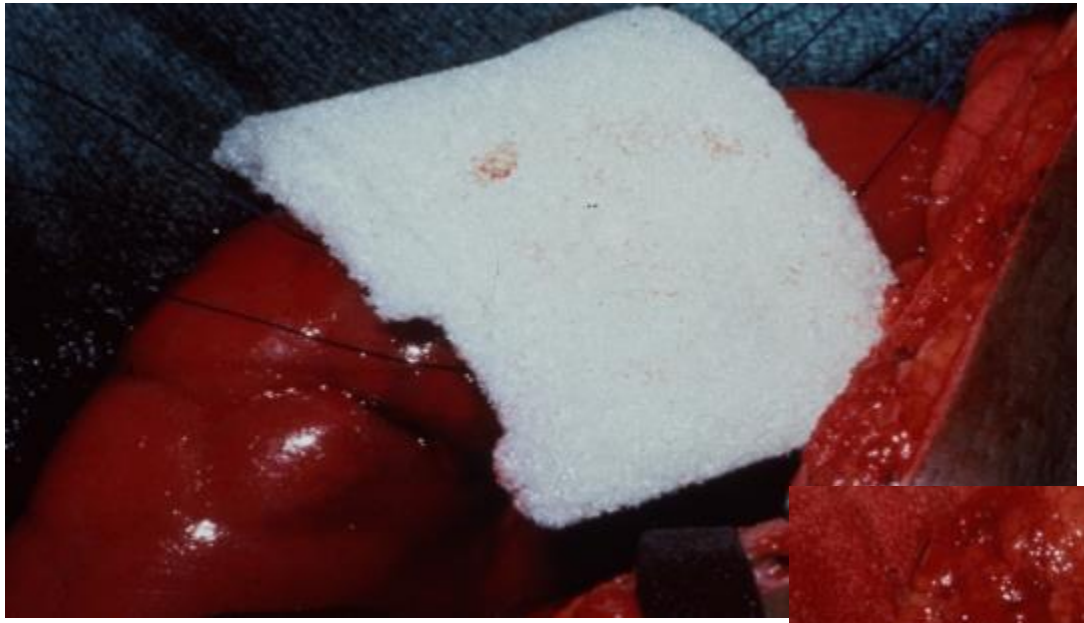


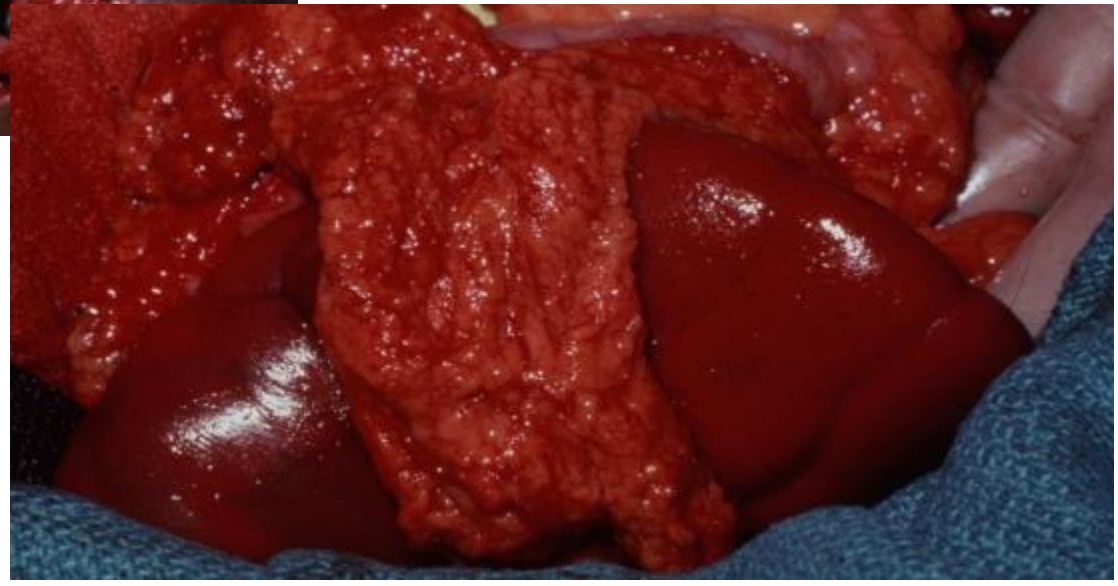
Kidney Reconstructive Techniques

- Renorrhaphy
- Collecting system closure
- Defect coverage
- Partial nephrectomy
- Vascular repair









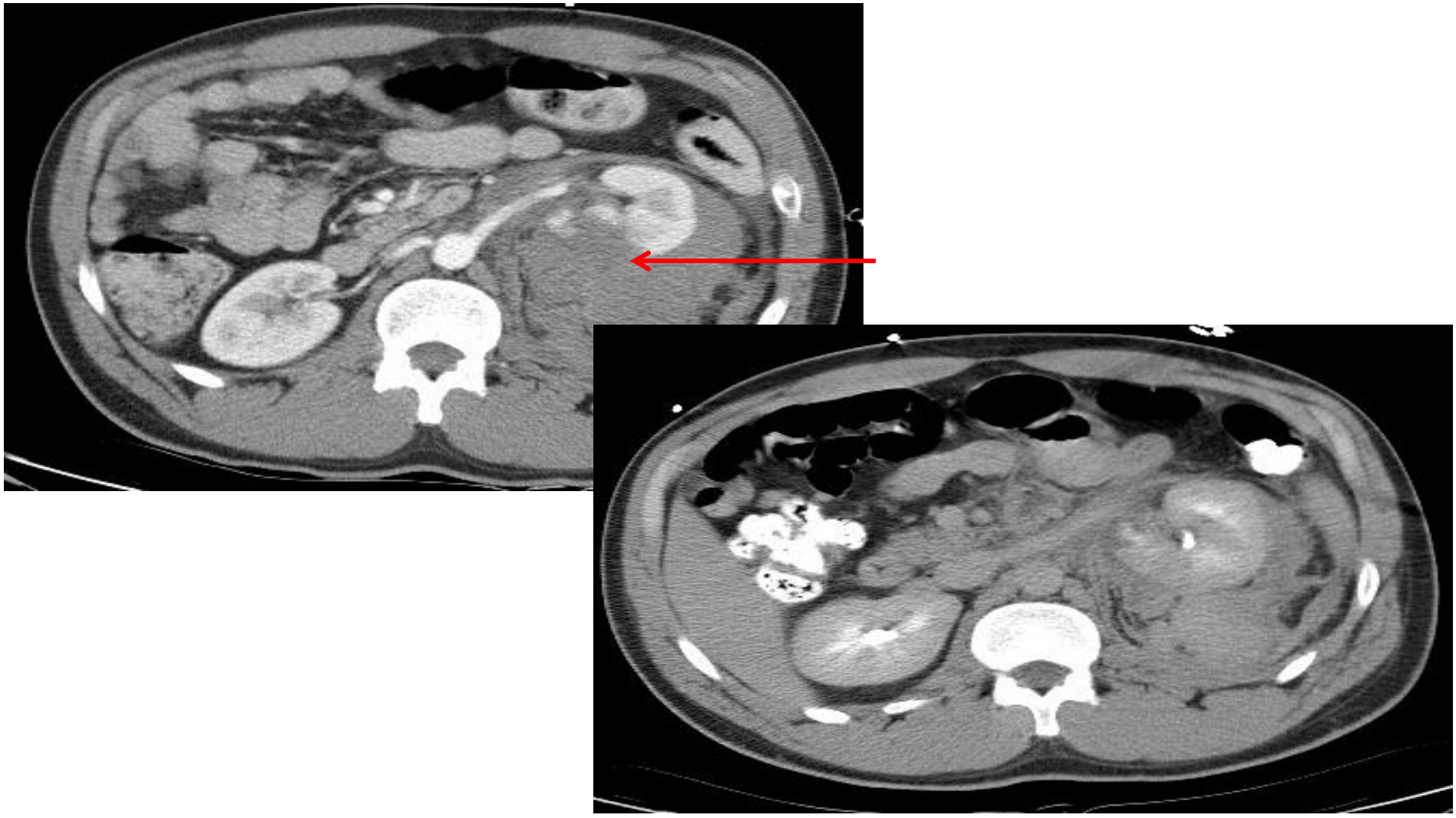
Renal Arteriography/Embolization

Indications

- Persistent bleed
- Arterial disruption where flow across the vessel is preserved
- AV fistula/pseudoaneurysm

Radiographic Predictors

- Perirenal hematoma size >3.5cm
- Intravascular constrast extravasaton
- Medial renal hematoma



Renal Arteriography/Embolization

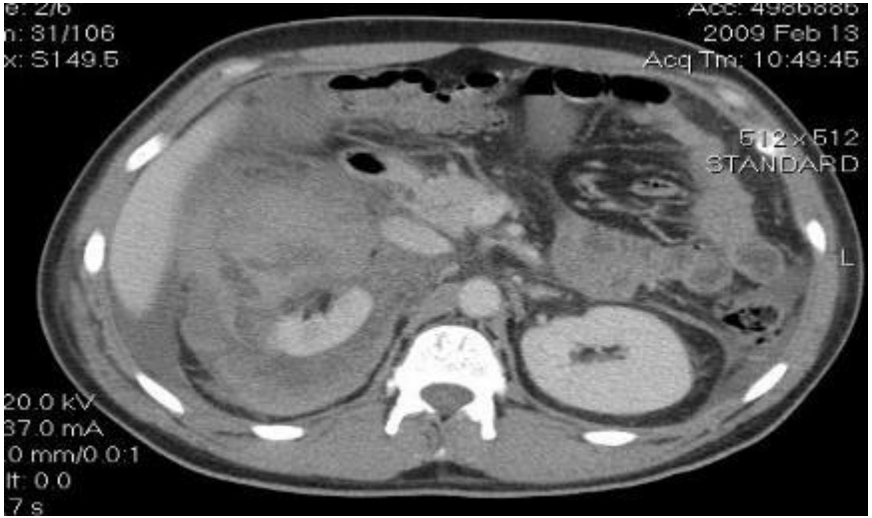
Complications:

- Clot dislodgment
- Bleeding
- Arterial dissection
- Coil migration
- Necrosis
- Renal insufficiency
- Pseudoaneurysm
- AV fistula

Renal Trauma

Management

6. Clinicians may initially observe patients with renal parenchymal injury and urinary extravasation.



8 months

I year


UNLUER ERTUGRUL
0.0
0.0
Left_Kidney
Right_Kidney
Left_Background
Right_Background
Bladder
Bladder Image
No Post-void Image
2-3 Minute Summed Image
Background Subtracted Kidney Curves
counts/min
minutes
Patient Information
Height (cm) 182
Weight (kg) 79.0
Age (years) 32.0
Isotope MAG3
Dose Injected (mCi) 10.00
Transplant NO
No Lasix
Function Results
Left
Right
Uptake (%) (2-3 min) 79.1 20.9
TTP (min) 3.25 4.25
Peak Count Rate (counts/min) 60583.8 20187.3
T 1/2 from peak (min) 6.27 16.85
Left Kidney : Bladder peak ratio 0.67
79.1
20.9

Renal Trauma

Followup

7. Clinicians should perform follow-up CT imaging for renal trauma patients having either (a) deep lacerations (AAST Grade IV-V) or (b) clinical signs of complications (e.g., fever, worsening flank pain, ongoing blood loss, abdominal distention).

Renal Trauma

Complications

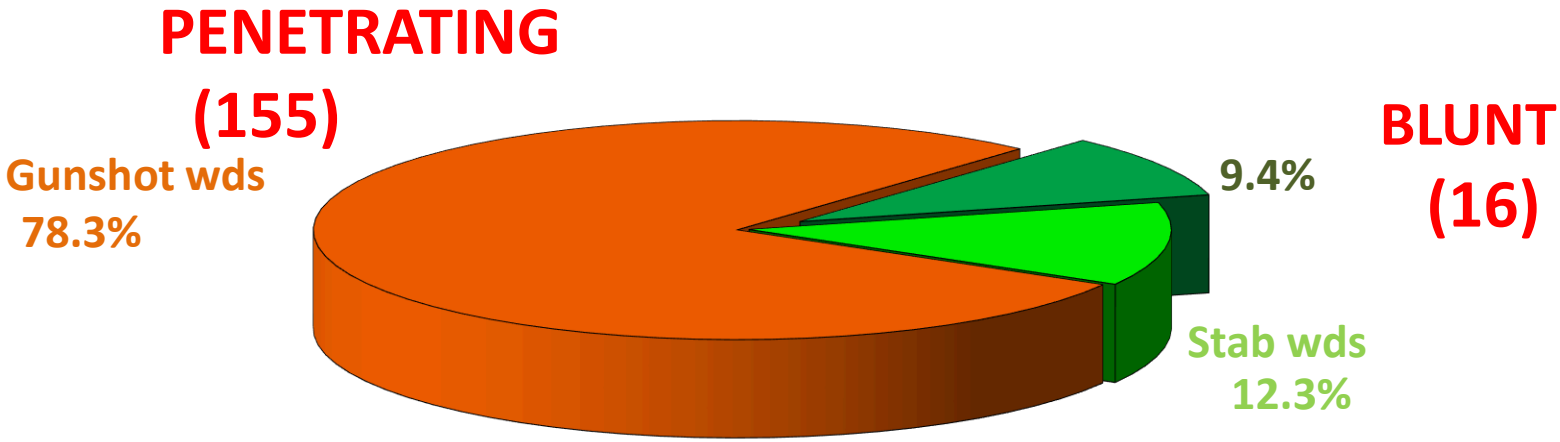
8. Clinicians should perform urinary drainage in the presence of complications such as enlarging urinoma, fever, increasing pain, ileus, fistula or infection. Drainage should be achieved via ureteral stent and may be augmented by percutaneous urinoma drain, percutaneous nephrostomy or both.

URETERAL TRAUMA

Ureteral Trauma

Diagnosis

9a. Clinicians should perform IV contrast enhanced abdominal/pelvic CT with delayed imaging (urogram) for stable trauma patients with suspected ureteral injuries.

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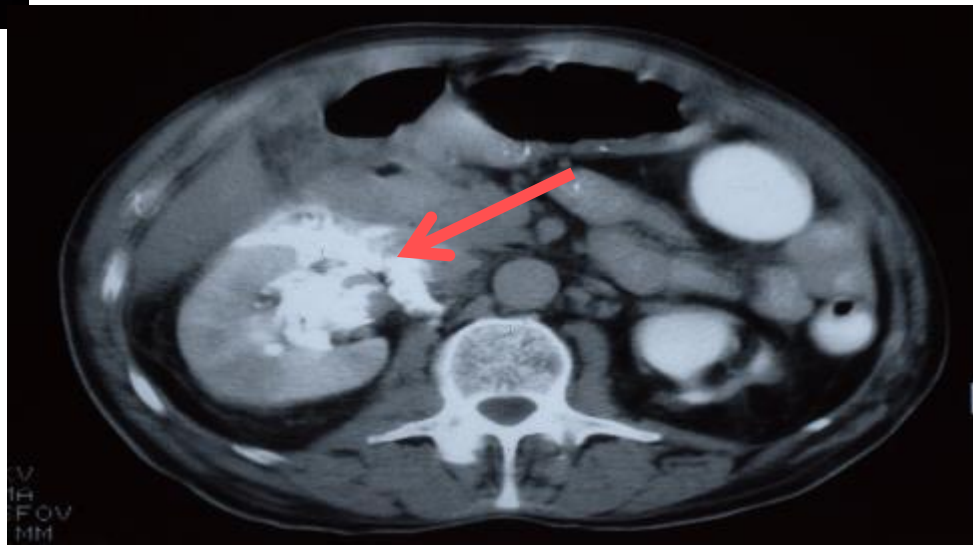


Ureteral Trauma

Diagnosis

9b. Clinicians should directly inspect the ureters during laparotomy in patients with suspected ureteral injury who have not had preoperative imaging.

Leakage

Discoloration

Decreased peristalsis

Methylene blue/Indigo carmine

Retrograde pyelography

Ureteral Trauma

Management

10a. Surgeons should repair traumatic ureteral lacerations at the time of laparotomy in stable patients.

- De-ligation
- Primary closure
- Ureteroneocystostomy
- Psoas hitch
- Boari flap
- Ureteroureterostomy
- Transureteroureterostomy

Ureteral Trauma

Management

10b. Surgeons may manage ureteral injuries in unstable patients with temporary urinary drainage followed by delayed definitive management.

>95% of patient will have associated injuries: bowel, vascular

Damage control (acidosis, coagulopathy, hypothermia)

- Ureteral ligation + percutaneous nephrostomy
- Temporary cutaneous tube ureterostomy

Ureteral Trauma

Management

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

Ureteral Trauma

Management

11a. Surgeons should attempt ureteral stent placement in patients with incomplete ureteral injuries diagnosed postoperatively or in a delayed setting.

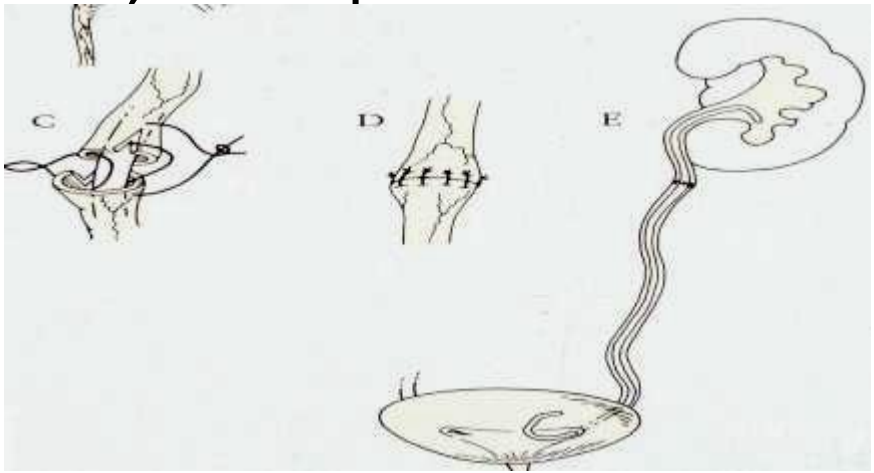
11b. Surgeons should perform percutaneous nephrostomy with delayed repair as needed in patients when stent placement is unsuccessful or not possible. (Recommendation)

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

Ureteral Trauma

Management

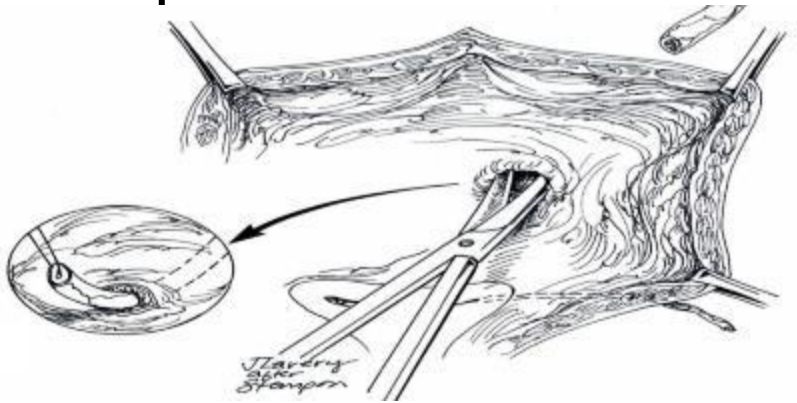
12a. Surgeons should repair ureteral injuries located proximal to the iliac vessels with primary repair over a ureteral stent, when possible.

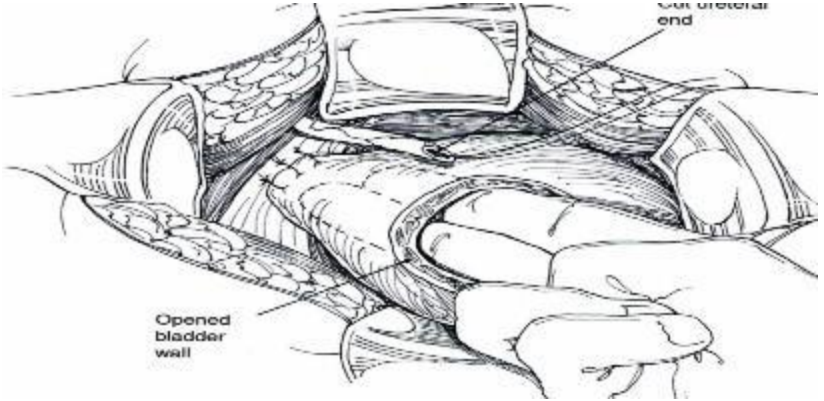


Ureteral Trauma

Management

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





Ureteral Trauma

Management

13a. Surgeons should manage endoscopic ureteral injuries with a ureteral stent and/or percutaneous nephrostomy tube, when possible.

13b. Surgeons may manage endoscopic ureteral injuries with open [or MIS] repair when endoscopic or percutaneous procedures are not possible or fail to adequately divert the urine.

BLADDER TRAUMA

Bladder Trauma

Diagnosis

14a. Clinicians must perform retrograde cystography (plain film or CT) in stable patients with gross hematuria and pelvic fracture.

Sites of Associated Injuries:
Blunt Trauma

Pelvis	**97%**
Long bones	50%
CNS	28%
Chest	28%
Spleen	19%
Small bowel	19%
Liver	13%
Colon	13%
Kidney	13%
Urethra	13%

Bladder Trauma

Diagnosis

14b. Clinicians should 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.

Indications for Bladder Imaging

Penetrating Trauma

- Any degree of hematuria with a projectile course near the bladder

Blunt Trauma

- **Gross hematuria with a pelvic fracture**

  or

- Gross hematuria without a pelvic fracture
- Microhematuria with a pelvic fracture

When associated with suggestive clinical indicators (suprapubic tenderness, inability to void, altered sensorium)

Iatrogenic Trauma

- Any patient with a delayed suspicion of a bladder injury

Bladder Imaging

Cystogram: *Conventional*

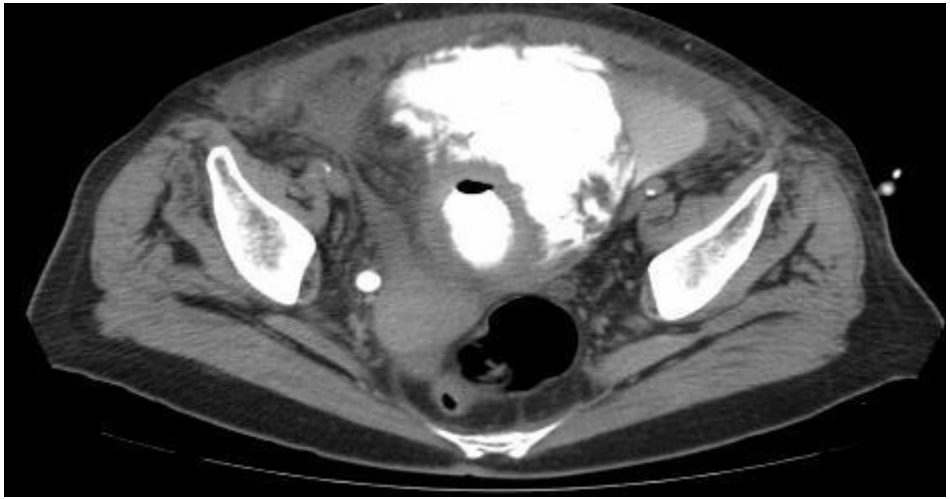
- ≥ 300cc contrast
- Filling and ***Drainage*** films
- Fluoroscopy

Cystogram: *CT*

- ***Retrograde filling***
- ≥ 300cc contrast (diluted)
- Films after filling only

Bladder volume in children (cc): Age + 2 x 30

Extraperitoneal Bladder Injury



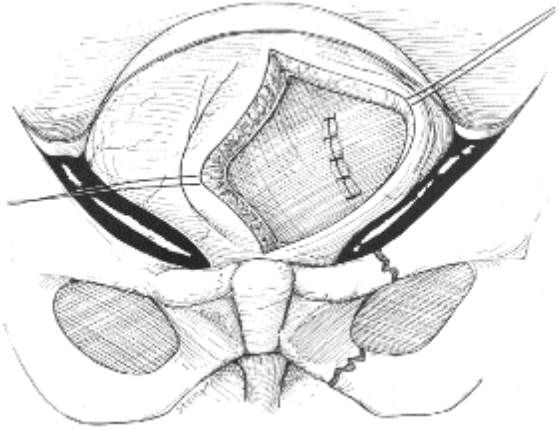
Intraperitoneal Bladder Injury

Bladder Trauma

Management

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

- Bladder exploration (midline ant. cystotomy)
- Inspection of bladder neck and orifices
- Limited debridement
- Repair of laceration(s)
- Peritoneotomy
- [MIS – laparoscopic option – selected cases]



Bladder Trauma

Management

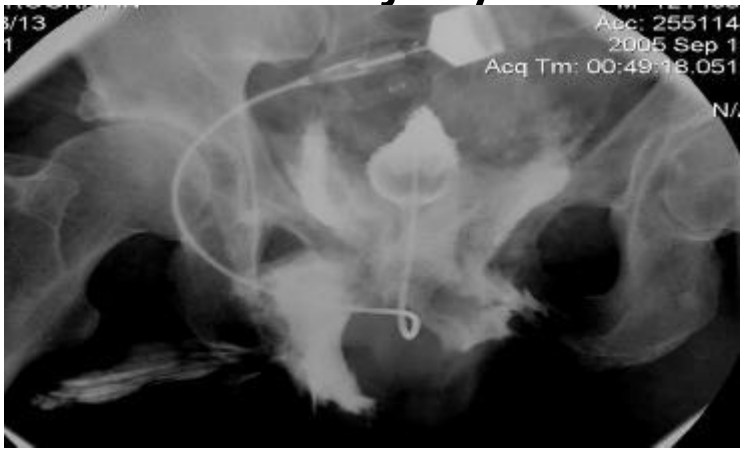
16. Clinicians should perform catheter drainage as treatment for patients with uncomplicated extraperitoneal bladder injuries.

Series	***# Pts***	***Complications***
Brosman (1976)	16	--
Corriere (1986)	39	--
Cass (1988)	31	--
Kotkin (1995)	27	7
Total	*113*	*6.19%*

Bladder Trauma

Management

17. Surgeons should perform surgical repair in patients with complicated extraperitoneal bladder injury.



- Bladder neck injury
- Concomitant vaginal or rectal injury
- Failure of adequate catheter drainage
- Iatrogenic injury identified during laparotomy
- Concomitant orthopedic/abdominal exploration

Bladder Trauma

Management

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

Exceptions:

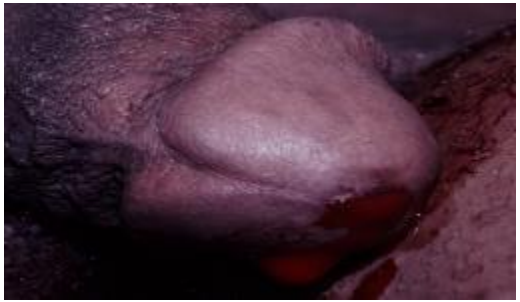
- Long-term catheterization
- Neurologic injuries (head and spinal cord)
- Complex bladder repairs

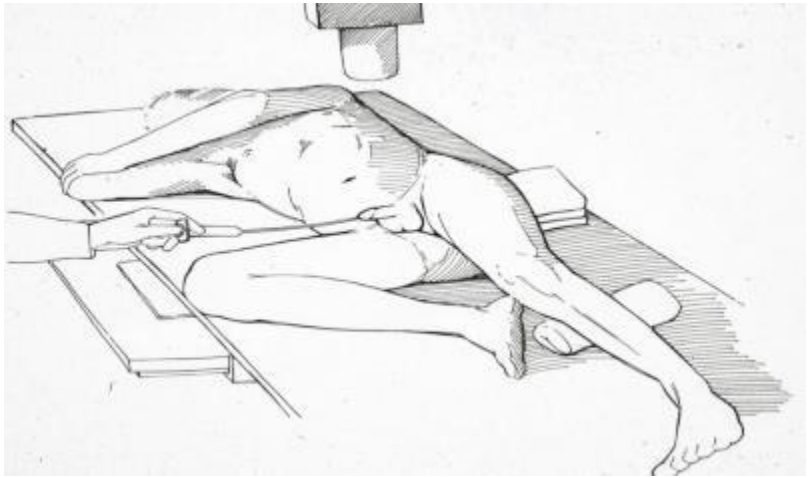
URETHRAL TRAUMA

Urethral Trauma

Diagnosis

19. Clinicians should perform retrograde urethrography in patients with blood at the urethral meatus after pelvic trauma.





Urethral Trauma

Management

20a. Clinicians should establish prompt urinary drainage in patients with pelvic fracture associated urethral injury.

20b. Clinicians should perform percutaneous or open suprapubic tube placement as preferred initial management for most pelvic fracture urethral injury (PFUI) cases.

Urethral Trauma

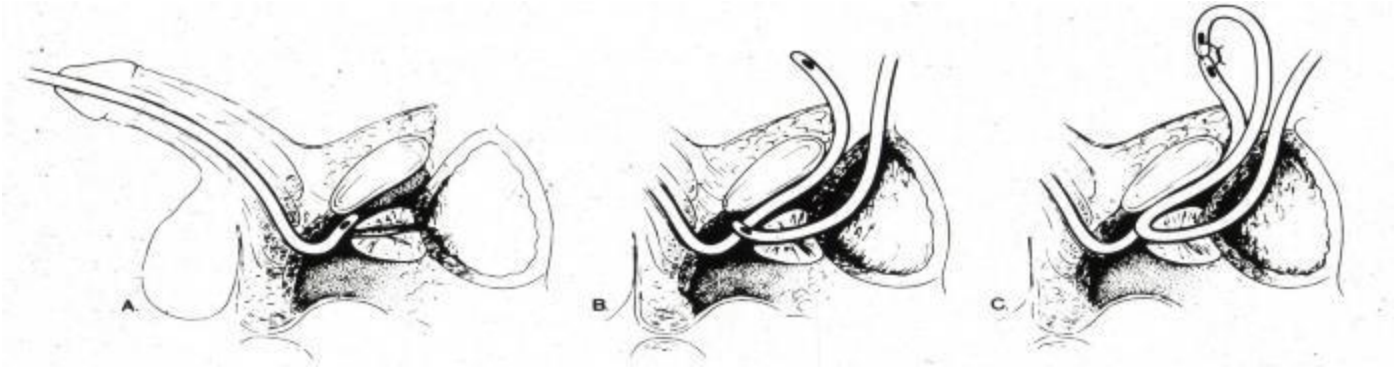
Management

21. Surgeons may place suprapubic tubes (SPTs) in patients undergoing open reduction internal fixation (ORIF) for pelvic fracture.

Urethral Trauma

Management

22. Clinicians may perform primary realignment (PR) in hemodynamically stable patients with pelvic fracture associated urethral injury. Clinicians should **not** perform prolonged attempts at endoscopic realignment in patients with pelvic fracture associated urethral injury.



Urethral Trauma

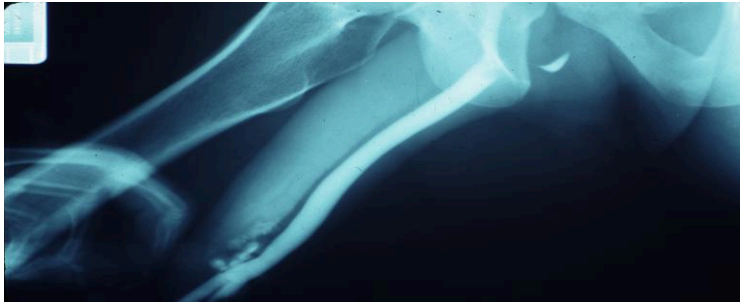
Complications

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

Urethral Trauma

Management

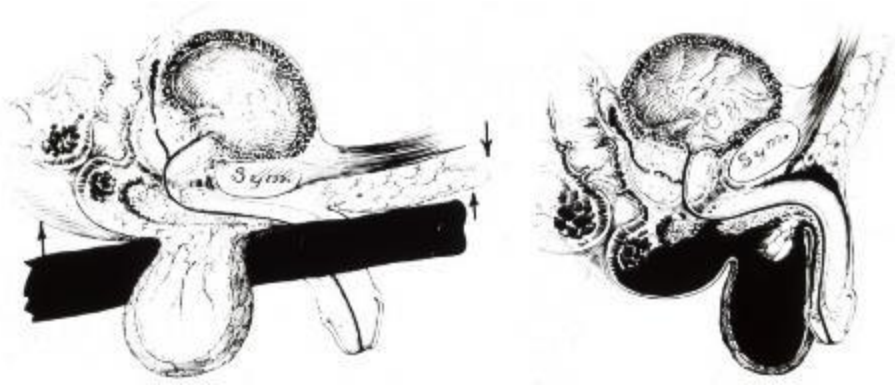
24. Surgeons should perform prompt surgical repair in patients with uncomplicated penetrating trauma of the anterior urethra.

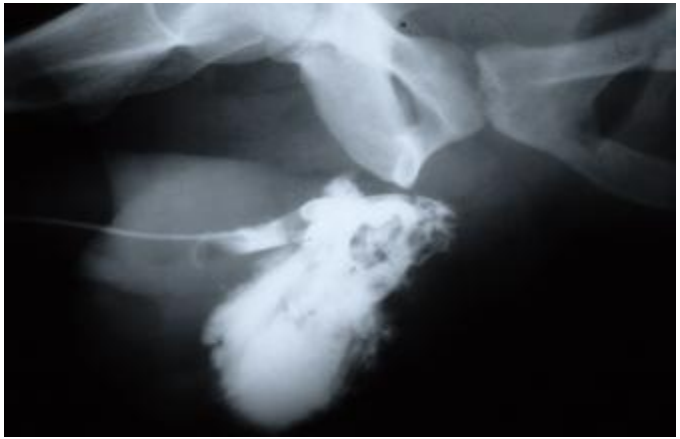


Urethral Trauma

Management

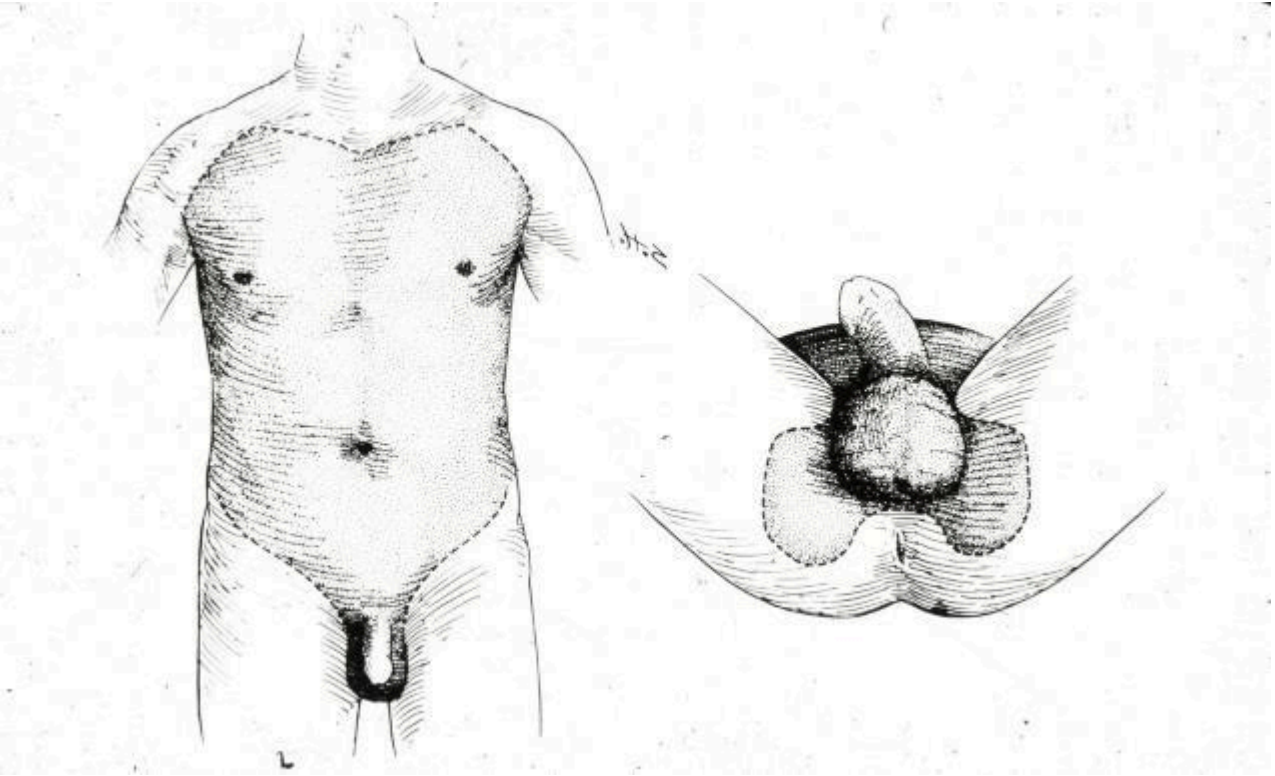
25. Clinicians should establish prompt urinary drainage in patients with straddle injury to the anterior urethra.





Patterns of Extravasation

Anterior Urethral Trauma



GENITAL TRAUMA

Genital Trauma: Role of the Urologist

- Trauma surgeons well versed in renal/bladder trauma
  - Most are NOT comfortable with genital trauma and/or genital surgery
  - Urologist is essential for initial and long term care
- Damage control principles apply
  - Stop bleeding, drain urine, preserve tissue
  - Get out of the way!
- Accurate initial staging, appropriate early management
- Ensure long term care for urinary, sexual, and reproductive complications

Genital Trauma: Initial Evaluation

- Genital injury staging
  - Exam → surgical exploration → cystoscopy
  - Radiographic:
    - RUG: urethra
    - Ultrasound: blunt scrotal trauma
- Pelvic poly-trauma:
  - Testicle injury → contralateral testicle, bulbar urethra
  - Deep penile laceration → pendulous urethra, corpora
  - Penetrating injury: remember bladder and ureters

Genital Trauma: General Considerations

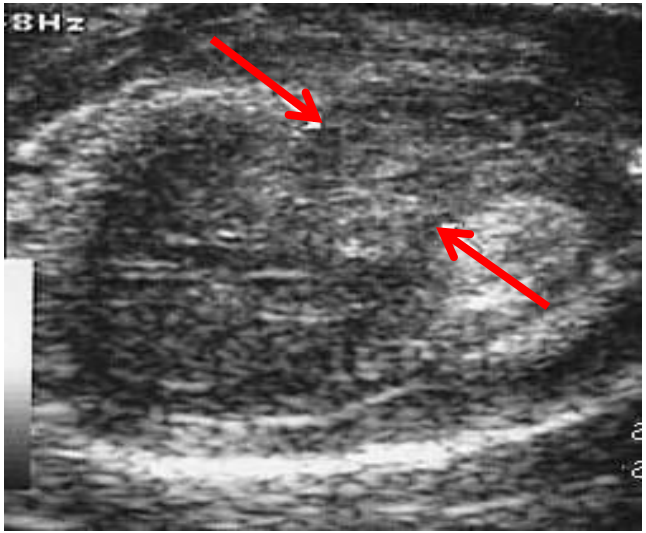
- Heterogeneity is the rule:
  - Blunt vs. penetrating vs. burns
  - High vs. low energy
  - Degree of soft tissue loss
- Unique etiologies of isolated penile trauma
  - Penile fracture
  - Amputation

Penile Fracture

- Triad of symptoms:
  - Audible crack/pop
  - Rapid detumescence
  - “Eggplant” deformity
- Urethral injury in 10-20%
  - Blood at the meatus
  - Hematuria

Penile Fracture

- 26. Suspect penile fracture in patients who after trauma to the erect penis (sex, masturbation, etc.) present with:
  - Penile ecchymosis/swelling
  - Cracking/snapping sound
  - Immediate detumescence
- 27. Promptly explore and repair
  - Longitudinal vs. circumcising incision
- 28. Consider penile US



Corpora Repaired w/ 2-0 PDS

Urethra Mobilized & Repaired With 4-0 PDS

Genital Trauma: Evaluate for Urethral Injury

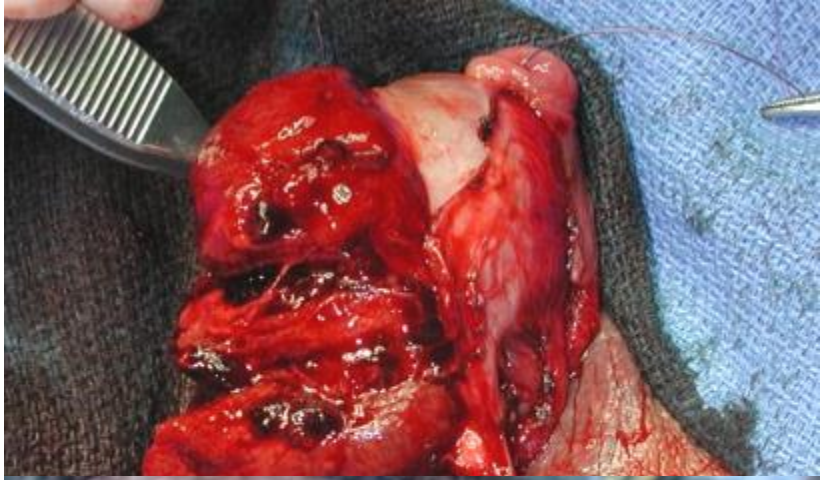
- 29. Evaluate for urethral injury in men with genital injury who present with blood at the meatus, gross hematuria, or inability to void.
  - Cystoscopy
  - Retrograde urethrogram
  - Exploration
    (also useful to identify corporal injury)

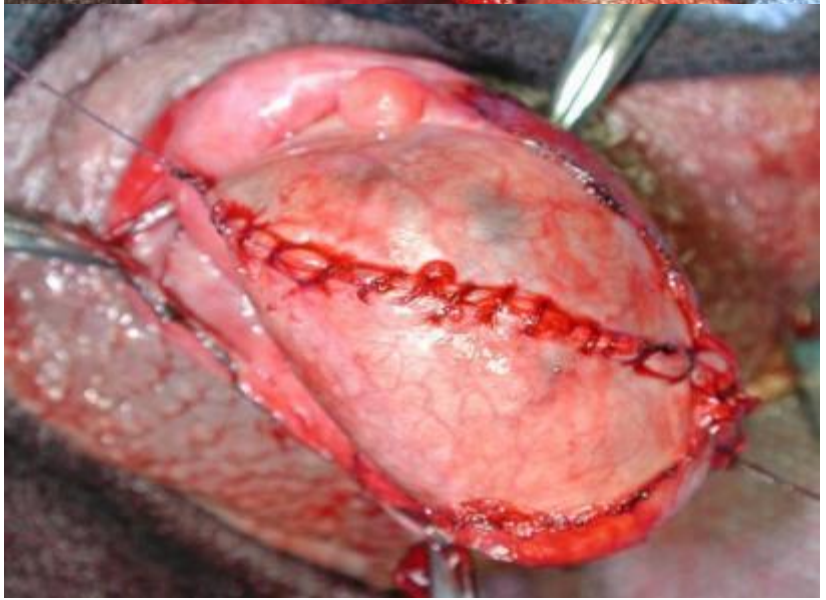
Testicular Rupture

- 30a. For blunt scrotal injuries, clinicians should perform scrotal ultrasonography for most patients having physical findings suggestive of testis rupture.

- 30b. For most penetrating scrotal injuries, clinicians should perform prompt surgical exploration with repair or orchiectomy (when non-salvageable) given the high rate of testicular injury and limited sensitivity of ultrasound in this setting.

- 30c. In patients with suspected testicular rupture, surgeons should perform scrotal exploration and debridement with tunical closure (when possible) or orchiectomy (when non-salvagable).






Tunica vaginalis graft

Genital Trauma:
Soft Tissue Loss

- 31. Explore and conservatively debride corporal/urethral/testicular tissue in patients with extensive genital soft tissue injury
  - Burns
  - Infection
  - Blast injury
- Why limited corporal, urethral, and testicular debridement?
  - Tissues are resilient/well vascularized
  - Organ replacement is problematic

Necrotizing Genital Infection

- Initial management:
  - ICU care
  - Broad spectrum antibiotics
  - Surgical debridement
    - Daily or QOD return to OR
    - Negative pressure dressing
  - Urethral vs. SP catheter
  - +/- colostomy
  - Nutrition
    - Early enteral feeding

Necrotizing Genital Infection

- Delay reconstruction until:
  - Infection controlled
  - Tissues granulating
- Surgical goals:
  - Cover tissue defects
  - Restore normal anatomy
  - Limit fibrosis/contracture
  - Functional Restoration
- Split thickness skin grafts are mainstay

Genital Skin Grafting

- Prepare wound bed
- Penis
  - Thick STSG (0.016”)
  - Mesh 1:1 (or not at all)
- Scrotum
  - Thin STSG (0.010”)
  - Mesh 1:1.5
- Tissue glues (Artiss®)
- Wound vac + bedrest for 5-7 days

Post-Skin Graft Care

- Vac removal in OR
- Dress with loose, humid gauze (i.e. Xeroform®)
- Supportive undergarment, phallus cephalad
- Ambulation, nutrition
- Re-graft if needed
- Resume sexual activity at 1-2 months
  - Consider early PDEI's, etc.

Penile Amputation

- 32. Promptly replant traumatic penile amputation. Wrap the amputated appendage in saline-soaked gauze and place in a plastic bag. Surround the bag in ice during transport.
  - Urologist: macroscopic structures (corpora, urethra, skin)
  - Microvascular surgeon: dorsal arteries/vein/nerves
  - Transfer to higher level of care if needed
  - Consult psychiatry and/or law enforcement as needed

Genital Trauma: Long Term Care

- 33. (New to 2017 update): Initiate ancillary psychological, interpersonal, and/or reproductive counseling and therapy for patients with genital trauma when loss of sexual, urinary, and/or reproductive function is anticipated.
  - Functional loss can be temporary or permanent
  - Sexual/reproductive dysfunction is a couples issue
  - Secondary mental health problems are common
- The urologist should advocate for such care, commonly neglected by the remainder of the trauma team.

Not Addressed by AUA Guidelines:

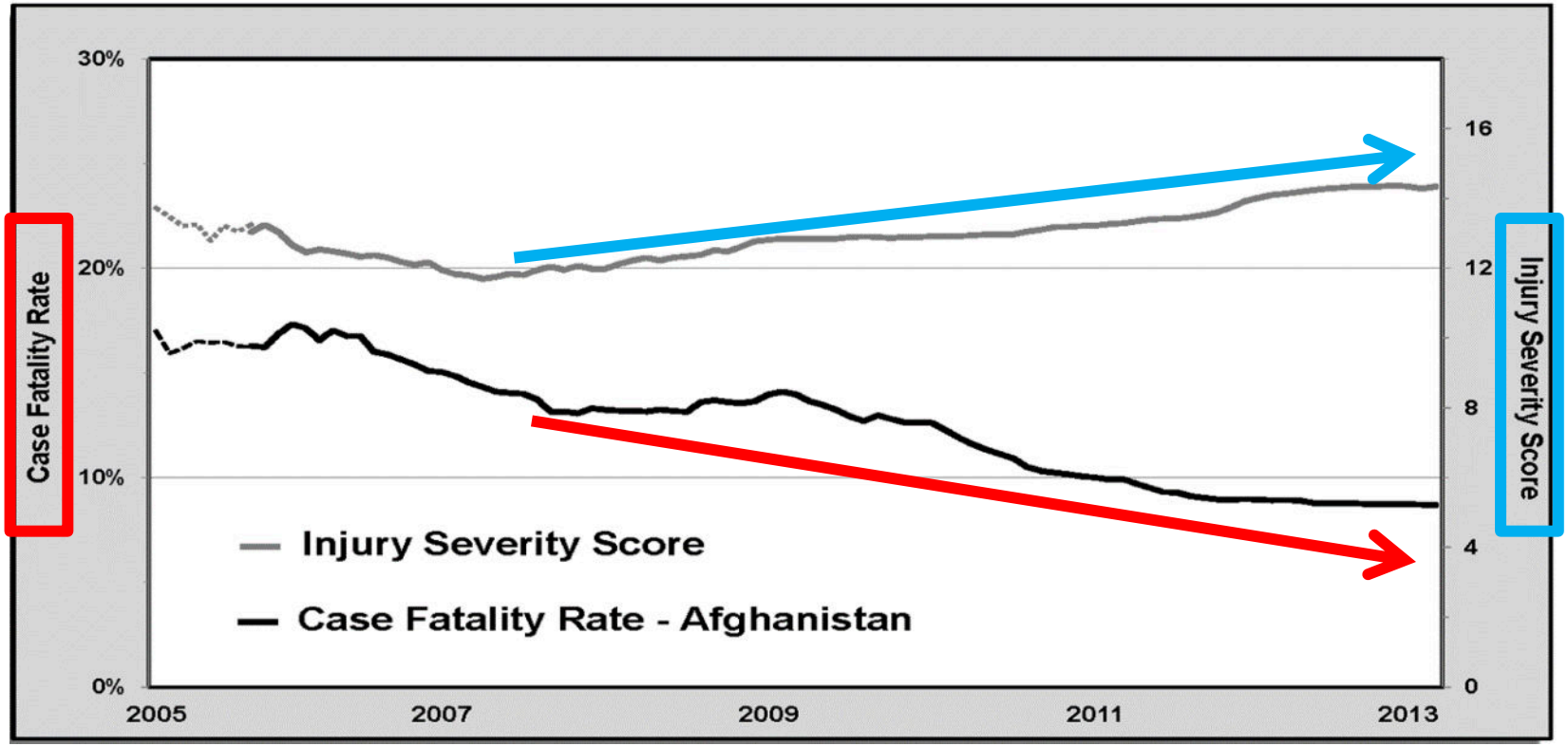
- Penetrating Corporal Injury:
  - Explore and repair
    - Circumcising incision vs. midline vs. penoscrotal
    - Close corporal defects (2-0 PDS)
- Female genital injury (pelvic fracture, GSW):
  - Signs: blood at introitus, inability to pass foley
  - Evaluation: EUA + Cysto
  - Multi-D management: uro, gyn, colorectal, ortho
    - Realign urethra over foley
    - Close urethral and vaginal lacerations

MILITARY UROTRAUMA

Urotrauma: Military vs. Civilian

- Similarities:
  - Medical and surgical management
- Differences:
  - Battlefield setting, austere environment/resources
  - Explosive mechanisms predominate
  - Rapid, step-wise global evacuation
- Relevance:
  - Rise in high energy mechanisms in non-military settings
  - All soldiers will eventually become civilians

Contemporary Battlefield Trauma: Increased Severity → Lower Mortality



Source: J Trauma Acute Care Surg 2013

Trauma Outcomes and Urogenital Health (TOUGH) Project

Epidemiology of Genitourinary Injuries among Male U.S. Service Members Deployed to Iraq and Afghanistan: Early Findings from the Trauma Outcomes and Urogenital Health (TOUGH) Project

CrossMark

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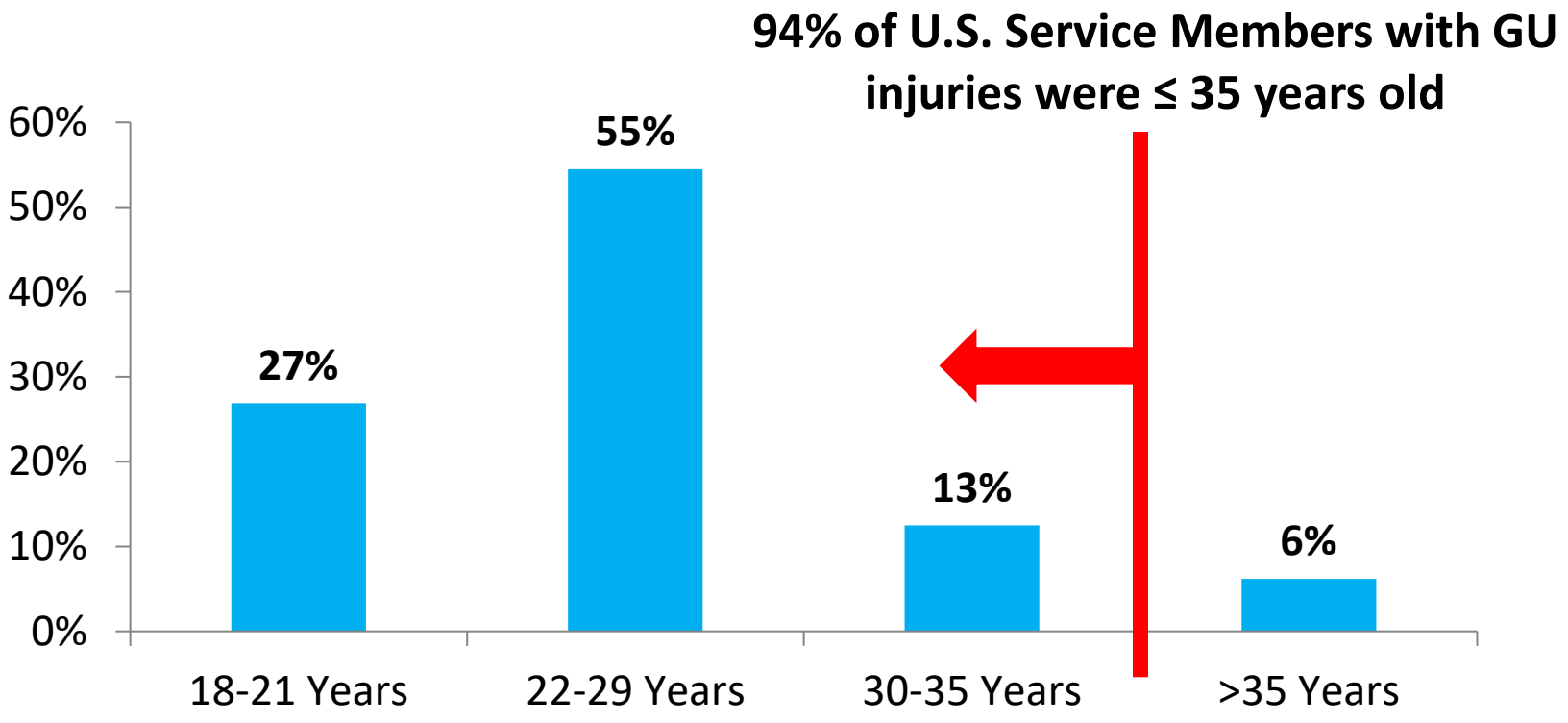
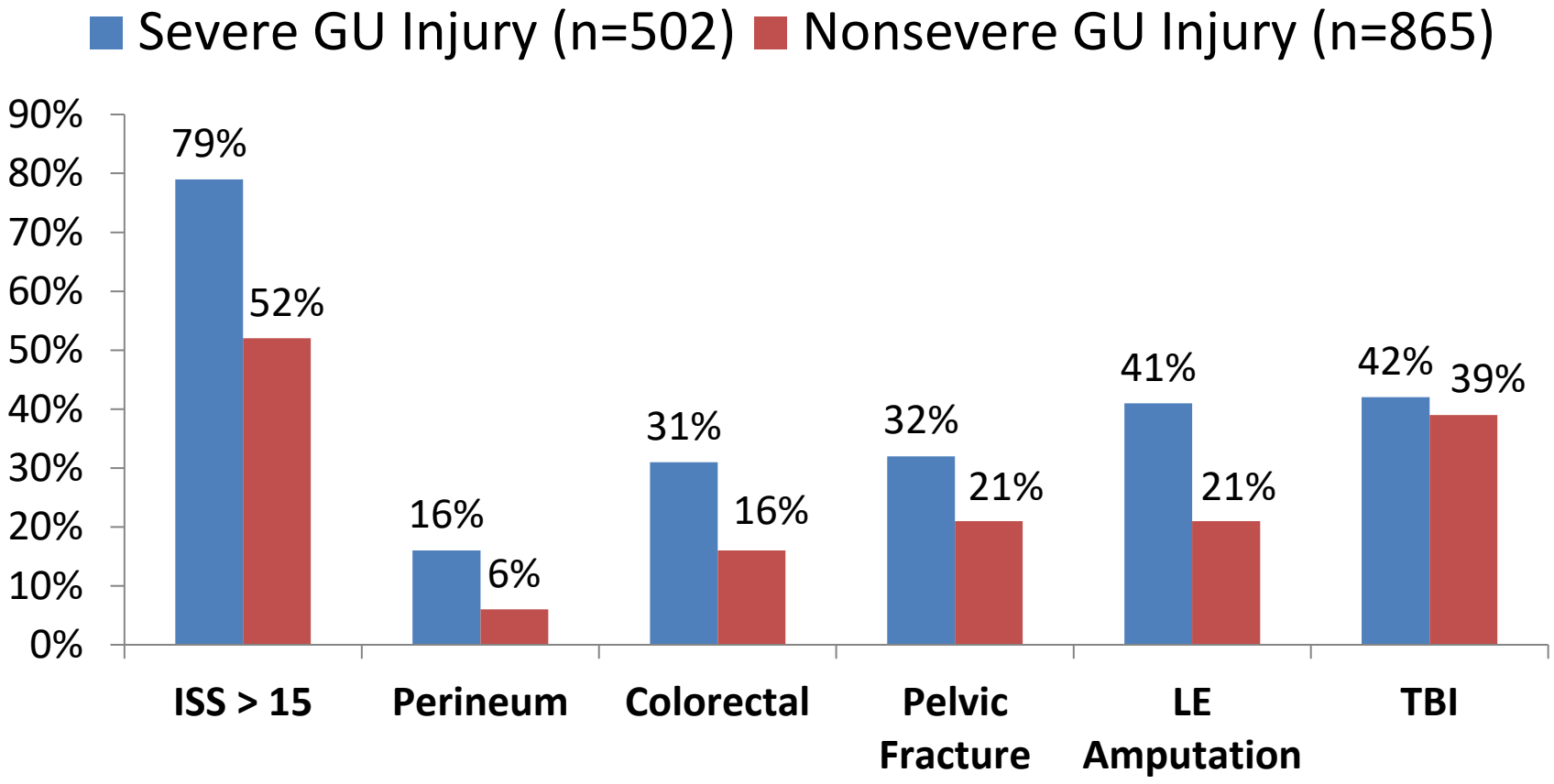
- 1,462 service members with GU injury (2001-2013)
  - Explosive mechanisms; penetrating injuries
  - 1,000 (73%) with genital injury(-ies)
  - 98.6% men
  - 5% died of wounds

Military Urotrauma Affects Young Men



Military Urotrauma= Polytrauma



Epidemiology of Contemporary Battlefield Urotrauma

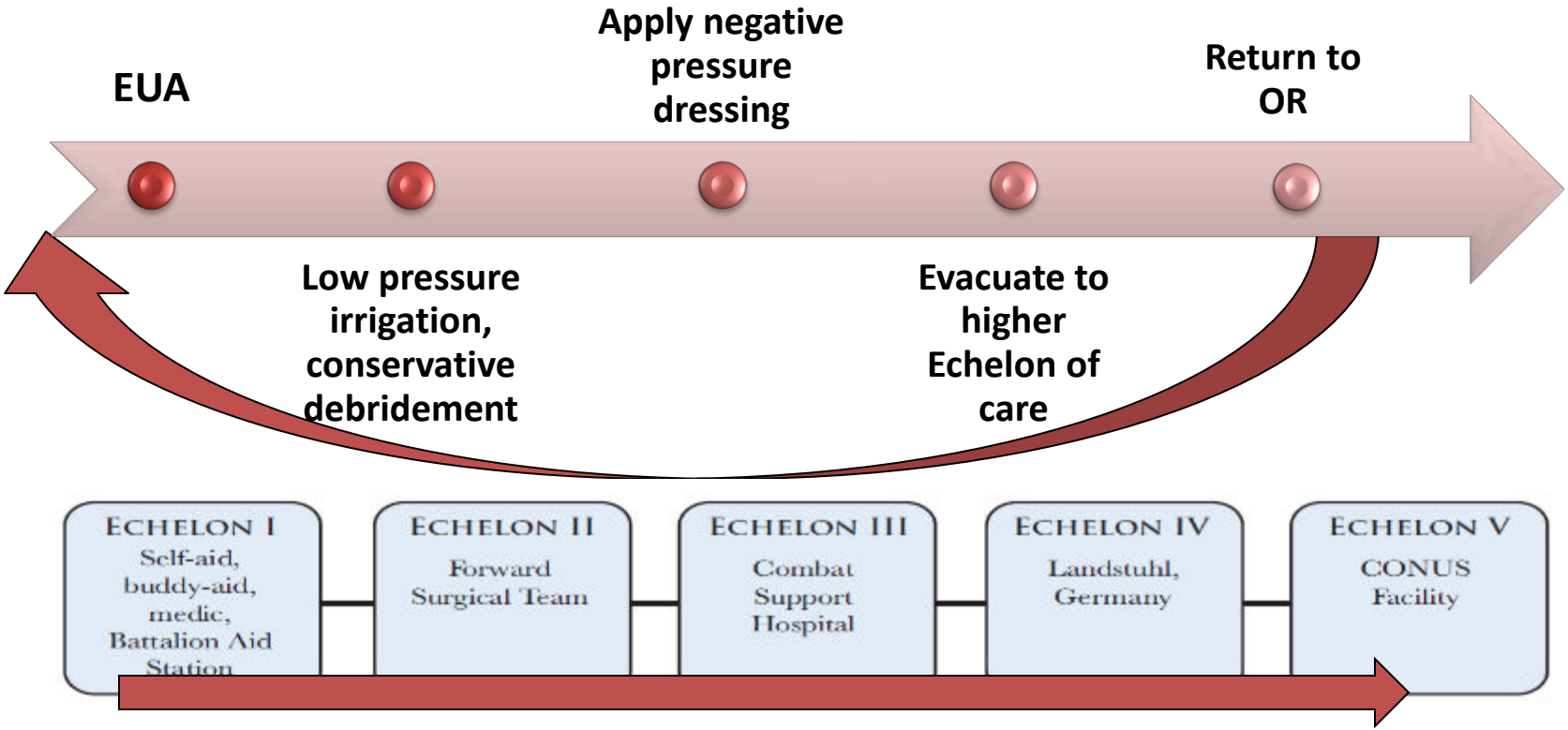
- ~1,300 surviving service members with Urotrauma
  - Mostly males < 30 y/o
- Genital injury most common
  - 75% of males with GU injury
- ~500 SMs with severe Urotrauma
  - Polytrauma
  - Group at highest risk for urinary, sexual, and fertility complications

Management of Battlefield Urotrauma

- Initial (hours to weeks):
  - Damage Control → stabilize, temporize, and evacuate
  - Drain/divert urine
  - Debride, irrigate, and dress external GU wounds
- Delayed (weeks to years):

- Long term (years +):

Battlefield Urotrauma: Initial Management



Courtesy of COL (ret.) James R. Jezior

Management of Battlefield Urotrauma

- Initial (hours to weeks):

- Delayed (weeks to years):
  - Heal wounds
  - Preserve tissue
  - Return of function → reconstructive/restorative surgery

- Long term (years +):

Complex Genital Injury

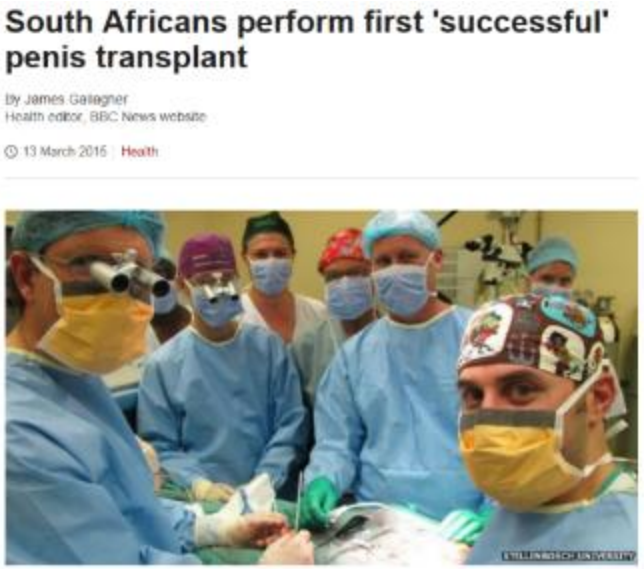
- Heterogeneity of wounds
- Algorithmic guidelines not feasible
- Overarching surgical principles:
  - Preserve native tissue
  - Restore function
  - Optimize cosmesis

Total Phallic Loss

- Rare, <1% of DoDTR series
- Conventional phallic replacement:
  - Forearm phalloplasty
- Limitations of autologous phalloplasty:
  - Multi-stage operation
  - Need for penile prosthesis
- Limited data in blast injury population
  - Largest series→3 patients
  - Forearm injury/amputation

Novel Approaches to Phallic Loss

- Regenerative medicine
- Penile transplantation
  - Risks of immunosuppression
  - Unique barriers in patients with severe penile injury:
    - Massive transfusion: 65%
    - LE amputation(s): 64%
    - Colorectal injury: 34%
    - Traumatic brain injury: 40%
- Very few military candidates



Devastating Testicular Injury

- More common than penile loss
  - Unilateral: 129 (9.4%)
  - Bilateral: 17 (1.2%)
  - Underestimate?
- Lifelong pharmacologic replacement
  - Costly. Risks?
- Loss of sperm production:
  - Cannot replace!
  - Pre-deployment sperm banking
  - Post-injury sperm salvage
  - Regenerative Medicine
- All show promise for fertility preservation after injury


Army Times A TEGNA Company

Military's new fertility benefit will let troops freeze their sperm and eggs

By Patricia Kime, Military Times 4:03 p.m. CST January 29, 2015


Seminal vesicle sperm aspiration from wounded warriors

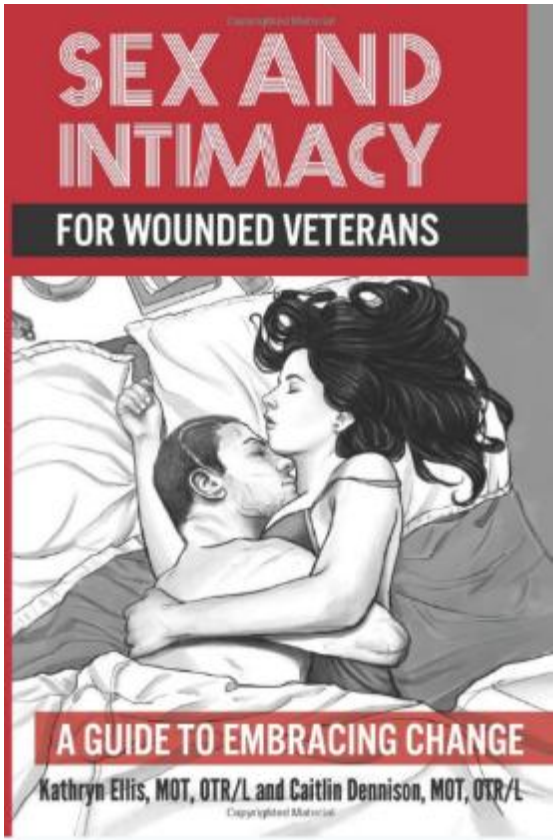
Mae Wu Healy, D.O.,[a,b] Belinda J. Yauger, M.D.,[a,b] Aidita N. James, Ph.D.,[c] James R. Jezior, M.D.,[d] Patrick Parker, D.O.,[d] and Robert C. Dean, M.D.[d]

Unique Considerations during GU Reconstruction in Polytrauma Patients

- Rigorous rehabilitation schedule
  - Convalescence after any surgery
  - Challenges with prosthesis fit after perineal/genital surgery
  - Post-injury rehab can take months → years!
- Coordinate with other surgeries (orthopedic, plastics, CRS)
- Restoration/rehabilitation of sexual function:
  - Pre injury: Young men at peak sexual performance
  - Narcotics, antidepressants, etc.
  - Hand injury/amputation
    - OT/PT trained in sexual rehabilitation?
  - Colorectal injury, LE amputation, depression, PTSD, etc.
    - Psychologists trained in sexual rehabilitation and intimacy?
  - Partner support?

Long Term Management of Urotrauma

- Initial (hours to weeks):
- Delayed (weeks to years):
- Long term (years +):
  - Sexual rehabilitation
    - Medical, device, and/or surgical assistance
    - PT/OT/PMR
    - Psychological, spousal, and interpersonal support
  - Fertility treatment
    - Donor sperm, IVF, etc.
  - Reconstructive urology f/u



Case Presentations

- 3-5 presentations will be presented to any bold audience members willing to participate
- Audience members should feel free to bring their own cases to “stump the panel”

THANK YOU!