Lower GU & Genitalia Trauma

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University of British Columbia
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Case

- 43 yo female MVC
- Pelvic # w/ significant bleeding per vagina
  - Vaginal packing
  - Bilateral angio embolization of internal iliac arteries
- Unable to insert urethral Foley → SP inserted
- Transferred to VGH:
  - Ortho, Gyne, Gen Surgery, Urology

Case

- PTD 0 (OR):
  - Ortho: External fixation
  - Uro: Cystogram
    - No bladder laceration
  - Gyne: Vaginal exploration/packing
  - Gen Sx: Diverting loop colostomy
Case: Female Urethral Trauma

- ? Leave w/ SP
- ? 1º realignment
  - ? When
  - ? How
- ? Repair vaginal lacerations

WWJD?

What Would Jennie Do?

What Would Jeff Do?
WWJD?

What Would Jack (McAninch) Do?

What Would Jamie (Wright) Do?

Overview

- Bladder
- Urethra
- Penile
- Testes
- Genital Skin Loss
- Case Presentation

Sources:
- EAU GU Trauma Guidelines, Feb 2003.
- Concensus (WHO) on GU Trauma, BJUI 2004.
Bladder Trauma

- Rare: <2% of abdo injuries requiring surgery
- Assoc. severe injuries
  - Often high-energy
- Urethral injury 15% (10-29%)
- Pelvic Fracture 6-10%  [Hochberg 1993, Cass 1987]
  - 85% of bladder injuries occur w/ pelvic #
  - Esp. pubic arch #
Bladder: Penetrating

- 2% incidence
- Assoc major abdo injuries (35%)
  - Shock (22%)
  - High mortality (12%)

Bladder: Grade (AAST)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury type</th>
<th>Description of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Contusion, intramural hematoma</td>
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<tr>
<td></td>
<td>Laceration</td>
<td>Partial thickness</td>
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<tr>
<td>II</td>
<td>Laceration</td>
<td>Extraperitoneal bladder wall laceration &lt;2 cm</td>
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<tr>
<td>III</td>
<td>Laceration</td>
<td>Extraperitoneal (&gt;2cm) or intraperitoneal (&lt;2cm) bladder wall laceration</td>
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<tr>
<td>IV</td>
<td>Laceration</td>
<td>Intraperitoneal bladder wall laceration ≥2cm</td>
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<tr>
<td>V</td>
<td>Laceration</td>
<td>Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or urethral orifice (trigone)</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple lesions up to grade III

From Moore et al. [2] with permission
Bladder: Classification

- 2002 Consensus Panel (Stockholm, Sweden)
  - Contusion (?%)
  - Extraperitoneal rupture (54-56%)
  - Intraperitoneal rupture (38-40%)
  - Combined intra- & extraperitoneal (5-8%)

Bladder: Dx– Hx, P/E

- Suspicion: Trajectory, Pelvic #
- Physical signs:
  - Abdo pain/ tenderness
  - Abdo bruising
  - No u/o via foley
- Delayed:
  - Fever
  - No void
  - Peritoneal signs
  - ↑ BUN, ↑ Cr, Abn lytes
**Bladder: Dx—Imaging Indications**

- **Absolute:**
  - Gross Hematuria w/ Pelvic #
    - Present in majority (>90%)
    - If use only gross hematuria & pelvic #:
      - Miss up to 10%
  - If use only gross hematuria & pelvic #:
    - Miss up to 10%

- **Relative:**
  - Microhematuria & Pelvic #:
    - Usually minimal injury (contusion)
  - Gross hematuria w/o pelvic #
  - Microhematuria (isolated)

- **Not:** Pelvic # without hematuria (EAU guidelines 2003)

  Consensus on Bladder Injuries. BJUI 2004; Kuan et al AUA US 2006

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**Bladder: Dx—Plain cystography**

- 350 cc
- 30% contrast
- Drainage films
  - 13% of injuries detected
- Accuracy: 85-100%
- False negatives w/ underfilling (250cc)

  (Cass J Trauma 1984)
Bladder: Dx– CT Cystography

- Preferred
  - Assoc pelvic visceral and bony injuries
  - Differentiate b/w hematoma & urinoma
  - Specificity 100%; Sensitivity 95%
- Retrograde filling w/ dilute contrast (6:1 w/ NS)
- Omit early fill and post-drainage phases
- Delayed CT IVP is NOT OKAY!!
  - Inadequate distension
  - Uncertain contrast volumes
  - False Negatives

Bladder: Dx- CT Cystogram

Antegrade cystogram false negative!!
**Bladder: Extraperitoneal**

- Almost always w/ Pelvic #
- Anterior lateral wall near bladder base
- Cystogram:
  - Flame-shaped extravasation
  - Extension: thigh, scrotum, anterior abdo wall, retroperitoneum

**Bladder: Extraperitoneal – Mx**

- Foley
- Cystogram @ 10 days
  - >85% healed @ 10 days
  - Vast majority healed @ 3 weeks

Bladder Concensus BJUI 2004.
Bladder: Extraperitoneal– Mx

- Indications for operative repair:
  - Bone fragment in bladder
  - Open pelvic fracture
  - Rectal injury
  - Vaginal injury
  - Bladder Neck injury/ Avulsion
  - Concomitant laparotomy anyways
  - Undergoing pelvic ORIF anyways
  - Poor drainage 2º to clots/bleeding

- Open repair → fewer complications (not statistically significant)
  - Early Cx: 5 vs 12%
  - Late Cx: 5 vs 21%

Bladder: Extraperitoneal– Repair

- Open bladder– inspect from inside out
- Check for assoc urethral, BN, prostate, rectal injuries
- Extraperitoneal rupture:
  - 1 layer repair transvesically
  - Close cystotomy (2 layers)
- Urethral foley
- +/- SP tube
**Bladder: Intraperitoneal**

- Rupture @ Dome
- Contrast:
  - Cul-de-sac
  - Outline bowel loops
  - Paracolic gutter

**Bladder: Intraperitoneal—Repair**

- Must be repaired
  - Urine leak → chemical peritonitis in 2-3 days
  - Laceration often larger than on cystogram
    - Avg 6 cm
    - Unlikely to heal spontaneously
- Repair in 2 layers
- Foley
  - Consider foley only if minimal iatrogenic injury (Consensus BJUI 2004)
- ?SP tube— not routinely necessary (Volpe JU 161:1103, 1999; Parry 2003)
**Bladder: Rupture——Cx**

- Rare
  - Especially in simple ruptures
- Frequency
  - Self limited (2 months)
  - Persistent in 2%

**Bladder: Penetrating—Mx**

- OR exploration/Repair
  - Definitive repair may be delayed if unstable
- Assess distal ureters
- Devitalized muscle: Limited debridement
- SP catheter not routine:
  - Anticipate long-term catheterization
  - Tenuous/Incomplete bladder repair

Concensus on Bladder Trauma. BJUI 2004.
**Bladder: Iatrogenic Injury**

- **Risk Factors:**
  - MIS Gyne:
    - 2-10 x risk vs. Open (Ostrzenski 1998)
  - XRT
  - Malignancy (esp if large)
  - Obesity
  - Pelvic hemorrhage
  - Distended/ thin bladder

<table>
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<tr>
<th>Injury Type</th>
<th>Frequency</th>
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<tr>
<td>Vaginal delivery</td>
<td>0.1</td>
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<tr>
<td>Cesarean section</td>
<td>1.0</td>
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<td>Cesarean section (in Zimbabwe)</td>
<td>17.7</td>
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<tr>
<td>Gynaecological surgery b/l laparoscopy</td>
<td>1.5</td>
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<tr>
<td>Hysterectomy:</td>
<td></td>
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<tr>
<td>Vaginal</td>
<td>9</td>
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<tr>
<td>For radical cancer</td>
<td>14</td>
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<tr>
<td>Obstetric</td>
<td>0.1</td>
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<tr>
<td>Gynaecological surgery b/l laparoscopy</td>
<td>0.3</td>
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<tr>
<td>Diagnostic</td>
<td>0.1</td>
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<tr>
<td>Sterilization</td>
<td>0.2</td>
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<tr>
<td>Hysterectomy (all)</td>
<td>0.10</td>
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<tr>
<td>Laparoscopically assisted vaginal hysterectomy</td>
<td>0.23</td>
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<tr>
<td>RIRS of bladder tumour (intraperitoneal)</td>
<td>0.25</td>
</tr>
<tr>
<td>BURP (peritoneal)</td>
<td>0.1</td>
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<tr>
<td>Laparoscopic bladder neck suspension</td>
<td>0.10</td>
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<tr>
<td>Tension-free vaginal tape for urinary incontinence</td>
<td>0.4</td>
</tr>
<tr>
<td>Laparoscopic herniotomy</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Per 1000 cases

**Bladder: Iatrogenic—Dx**

- **Signs:**
  - Clear fluid in field// Visible laceration
  - Gas distension of urinary drainage bag (MIS)

- **Dx procedures:**
  - Direct inspection// Intentional cystotomy
  - Methylene blue or indigo carmine
  - Cystoscopy (preferred in vaginal surgery)
  - Cystogram

Consensus on Bladder Trauma. BJU 2004.
**Bladder: Iatrogenic—Mx**

- Establish extent of injury
- Similar to external trauma
- MIS repair if: (level 4,5 evidence)
  - Small injury
  - Adequate expertise
  - Adequate exposure
  - Ureters or BN not compromised

Concensus on Bladder Trauma. BJUI 2004.

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**Urethral Trauma**
Posterior Urethra: Etiology

- Pelvic Fractures (4-14%)
  - High Risk:
    - Straddle
    - Malgaigne
  - Posterior arch involvement ↑ risk
  - Can occur w/o Pelvic # (rare)
    - Blunt perineal trauma
  (Koraitim 1996; Lowe 1988)

Posterior Urethra: Etiology

- **Straddle**
  - 4 rami #
  - Lateral compression
  - OR 3.85

- **Malgaigne**
  - Ipsilateral
  - Vertical shear
  - OR 3.40

Posterior Urethra

- Mostly males (>98%)
- Bladder rupture in 10-17%
- Rectal injury:
  - 5% of pelvic # (Consensus Urethra. BJUI 2004)
  - DRE: Bloody finger
  - → urethrorectal fistula in up to 8%

Posterior Urethra: Dx

- Blood @ meatus (50%)
  - Amount does not correlate to injury severity (Colapinto 1977)
- “High-riding prostate” (34%)
  - False +ve: Pelvic hematoma
- Inability to urinate
- Inability to place urethral catheter
- Perineal hematoma (late)
**Posterior Urethra: Dx**

- **RUG**
  - (Retrograde Urethrogram):
    - 14 Fr foley 1-2 cm into fossa
    - Inflate 1-2 cc in balloon
    - 30% contrast injected 10 cc at a time
    - Flouro or static

**Posterior Urethra: Classification**

Colopinto (1977)/ Goldman modification (1997):

- **I:** Urethral Stretch (10-15%)
- **II:** Disruption Proximal to GU Diaphragm (10-15%)
- **III:** Disruption both Proximal and Distal to GU diaphragm (66-85%)
- **IV:** Bladder Neck injury extends into urethra (rare)
  - IVa: Extraperitoneal bladder rupture @ bladder base w/ periurethral extrav
- **V:** Pure anterior urethra injury

Posterior Urethra: Classification

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<thead>
<tr>
<th>Grade</th>
<th>Injury Type</th>
<th>Description of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Blood at urethral meatus; retrograde normal</td>
</tr>
<tr>
<td>II</td>
<td>Stretch</td>
<td>Elongation of urethra without extravasation on urethrography</td>
</tr>
<tr>
<td>III</td>
<td>Partial</td>
<td>Extravasation of urethrography contrast at injury site with visualization in the bladder</td>
</tr>
<tr>
<td>IV</td>
<td>Complete</td>
<td>Extravasation of urethrography contrast at injury site without visualization in bladder; &lt;2cm of urethral separation</td>
</tr>
<tr>
<td>V</td>
<td>Complete</td>
<td>Complete transaction with &gt;2 cm urethral separation, or extension into the prostate or vagina</td>
</tr>
</tbody>
</table>

*Advance one grade for bilateral injuries up to grade III

From Moore et al. [3], with permission

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Posterior Urethra: Partial

- **Dx:** Extravasation w/ partial filling of bladder/proximal urethra

- **Partial vs Complete:**
  - May be no radiologic difference
    - Proximal filling obscured by gross extravasation or by spasm of external sphincter (Herschorn J U 148:1428, 1992.)
  - Accurate Dx can be difficult
Posterior Urethra: Mx

- Open 1º Realignment
  - NEVER do it
  - ↑ Impotence (44-56%)  
    (Webster 1983, Korantin 1996)
  - ↑ Incontinence (20%)  
    (Webster 1983)
  - ↑ Stricture formation (69%)  
    (Webster 1983; Coffield 1977)
  - Potential explosive blood loss

Posterior Urethra: Mx

- 1º Endoscopic Realignment
  - 35-50% stricture  
    vs 96% stricture w/o alignment  
    (Kotkin 1996; Asc 1999)
  - Most stricture are mild
    Mx: Dilation or DVIU  
    (Al-Ai 1983; Herschorn 1992)
  - As few as 7% require urethroplasty
    Makes urethroplasty easier  
    (Kotkin 1996)
Posterior Urethra: Mx—1º realign

- Timing: as immediate as practical
  - <72 hr (no data)
  - Some successful up to 19 days after!
- No worsening of impotence/incontinence
  - Pelvic # injury responsible
- No Traction
  - Pressure on BN→ ↑ incontinence

Posterior Urethra: Mx—1º realign

- Gentle attempt foley x1
  - No evidence of converting a partial to complete tear
  - Confirm placement by cystogram
- Flexible cystoscopy (bedside)
- Open cystotomy, Urethral cath & SP catheter:
  - Antegrade flex cystoscopy/ Guidewires
  - 8 Fr ped feeding tube (Antegrade)
  - Davis interlocking sounds
  - Finger guided sound
  - Magnetic sounds
**Posterior Urethra: Mx**

- Foley x 6 wks
  - VCUG or pericatheter RUG
- SP tube x1-2 wks after VCUG
  - Ensure long-term patency
- SP catheter:
  - Ortho hardware infection? No evidence *(Routt 1996)*
  - Assoc Rectal Injury *(Koraitim 1999)*
    - Open exploration, irrigation, repair & drains
    - Urethral injury does not need exploration

**Posterior Urethra: Mx**

- If unable to get Foley in:
  - Open SP catheter
  - Inspect/repair bladder for assoc injury
  - Deferred 1º Repair (>3 mo) recommended
    - Level III evidence *(Consensus on Urethral Trauma BJUJ 2004)*
  - Avoid Immediate (<48 hr) or Delayed (2-14 days) 1º Repair
    - ↑ morbidity: ED, Incontinence, Re-stenosis
**Posterior Urethra: Cx– ED**

- **Etiology:**
  - Penile parasympathetic injury (Turner-Warwick 1989)
  - Arterial insufficiency (Armenakas 1993)

- **Incidence:**
  - Partial disruptions: 13-30%
  - Complete distraction: 48-72%

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**Posterior Urethra: Cx– Incontinence**

- ? Damage to external sphincter
  - Site of distraction: Bulbomembranous junction (BJU 2004)
    - Not Prostatomembranous (Mouraviev & Santucci JU 2005)
  - Bladder neck provides continence

- **Incidence:**
  - Total incontinence uncommon (2-4%) (Elliot 1997)
  - Mild: 6%
  - Areflexic bladder 10% (Corriere 1996)
Anterior Urethra: Etiology

- Rare
- 10% of all urethral injuries
- Isolated
- Straddle injury (majority) and gunshot wounds
- Bulbar urethra most frequent site (85%)

Anterior Urethra: Dx

- High index of suspicion
- Swelling under Buck’s and/or Colles
  - Penile/Butterfly hematoma
- RUG

Gunshot wound
Anterior Urethra: Mx

- Open Anastomotic Repair
  (Preferred but literature not clear)
  - Tension-free
  - Spatulated, Watertight
  - Foley
  - Minimal debridement
- Foley/SP if shotgun or massive tissue destruction

Urethra: Mx Algorithm

Penile Trauma

Penis: AAST

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cutaneous laceration/contusion</td>
</tr>
<tr>
<td>II</td>
<td>Buck’s fascia (cavernosum) laceration without tissue loss</td>
</tr>
<tr>
<td>III</td>
<td>Cutaneous avulsion</td>
</tr>
<tr>
<td></td>
<td>Laceration through glans/meatus</td>
</tr>
<tr>
<td>IV</td>
<td>Cavernoal or urethral defect &lt;2 cm</td>
</tr>
<tr>
<td>V</td>
<td>Partial penectomy</td>
</tr>
<tr>
<td></td>
<td>Cavernoal or urethral defect ≥ 2 cm</td>
</tr>
<tr>
<td></td>
<td>Total penectomy</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries up to grade III

From Moore et al. [1], with permission
Penis: Amputation

- Etiology: self mutilation most common
  - 87% acutely psychotic
- Reimplant if possible
  - Formalize amputation if not
- Keep amputated penis in wet sterile gauze in sterile baggy, put baggy on ice (<24 hr cold ischemia time)

Aboueif 1993; Lowe 1991
**Penis: Amputation—Reimplant**

- Begin ventrally
  - Macroscopic reimplant: urethra & corpora
  - Deep cavernosal arteries not reanastomosed
- Microscopic:
  - Dorsal: Nerves, arteries, and deep dorsal vein
  - Improves Outcomes
- Urethral foley & SP

Consensus BJUI 2004; Wessells 2006

**Penis: Amputation—Outcome**

- Post-Op:
  - Venous congestion
  - Many do well
  - Lose glans sensation & ejaculatory fn
  - 18-25% strictures, fistulae
Penis: Gunshot

- Rare
- W/U: Urethrogram (50% involvement)
- Rx associ injuries
- Mx: Repair primarily
  - Unless massive tissue destruction
- Results: Poor F/U; reasonably low Cx

Penis: Fracture

PENILE FRACTURE IN KERMANSHAH, IRAN: REPORT OF 172 CASES

JAVAAD ZARGOOSHI

From the Department of Urology, Kermanshah University of Medical Sciences, Kermanshah, Iran


<table>
<thead>
<tr>
<th>Mechanism of penile fracture</th>
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<tr>
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<tr>
<td>&quot;Light-touch&quot; (to check if the erect penis is adequate)</td>
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<tr>
<td>Being struck by a weapon (knife, gun) or other foreign body</td>
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<td>Being struck by a weapon</td>
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<td>Being struck by a weapon against a hard object</td>
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<tr>
<td>Falling from a height, striking a hard object</td>
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Penis: Fracture

- Hx:
  - Blow to erect penis
  - Popping sound
  - Penile detumescence & pain
  - Classic findings not universally seen
  - Delay in presentation common

- P/E:
  - Eggplant deformity
    - Highly diagnostic (Zargooshi 2000)
  - Butterfly sign
  - Rolling sign—clot near fracture site

Penis: Fracture—Investigations

- Urethral injury
  - up to 20-38% in US & Europe
  - 0-3% in Japan & Middle East (↓ force of injury)
  - If suspected → RUG

- MRI, U/S and cavernosography
  - Limited role
  - Clinical picture/Dx usually clear
  - MRI: more sensitive than U/S or cavernosography (Fedel 1996)
    - Rule out penile # → Conservative Mx (LOE: 5)
  - No prospective studies to define appropriate use (AUA US 2006)
Penis: Fracture—Mx

- Surgery
  - Circumcising incision (LOE: III)
    - Alt: direct incision; parapenile
  - Foley to prevent urethral injury
  - Absorbable sutures
    - Laceration: 0.5-4cm
  - Test integrity of urethra & corpora
    - Mydo JU 2001
- Urethra: Partial transection
  - Foley or SP alone
  - 1º repair over foley

Penis: Fracture—Surgery

- Better outcomes vs Conservative Mx (LOE: III)
  - Curvature—mild <5% vs 10-30%
    - Nicolaisen 1983; Tan 1989; Asgar 1996
  - Plaque formation/ Fibrosis
  - Shorter hospital stay
  - ED (low: 1.3%)
    - Orvis & McKinich 1989; Haas 1999
  - Immediate (<36 hr)
    - Better outcomes (LOE: III)
      - Concensus Ext Genitalia. BJUI 2004
    - Less chronic curvature
      - Asgar. JU 1996
**Penis: Zipper**

- Cut slider w/ orthopedic pin cutter & disconnect
- Local block, mineral oil lubrication & manual attempt to unzip
- Individually pull zipper teeth apart w/ hemostat

**Testes**
Testes

- Rare
- In significant scrotal blunt trauma
  - Rupture as high as 50%
- Bilateral 1.5%
- Etiology: Assaults, Sports injuries
- Local anesthetic block may improve exam

Testes: AAST

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
</tr>
<tr>
<td>II</td>
<td>Subclinical laceration of tunica albuginea</td>
</tr>
<tr>
<td>III</td>
<td>Laceration of tunica albuginea with &lt;50% parenchymal loss</td>
</tr>
<tr>
<td>IV</td>
<td>Major laceration of tunica albuginea with ≥50% parenchymal loss</td>
</tr>
<tr>
<td>V</td>
<td>Total testicular destruction or avulsion</td>
</tr>
</tbody>
</table>

*Advance one grade for bilateral lesions up to grade V
From Moore et al [1], with permission
**Testes: Dx– U/S**

- Testicular rupture:
  - Loss of normal homogeneity
    - Diagnostic (Level of Evidence: II) (Consensus Ext Genitalia BJUI 2004)
  - Loss of continuity of tunica albuginea
    - Discrete break in tunica not often seen (20%) (Lewis 1991)
  - Intraparenchymal hematoma
  - False negatives
  - Specificity 75%, Sensitivity 64%
  - PPV 78%, NPV 60% (Consensus BJUI 2004)

  @ UCSF, Single finding: Heterogeneous echo pattern w/ loss of contour definition
  - Improved sensitivity (100%), maintained specificity

**Testes: Blunt—Mx**

- History & Exam suggests rupture
  - → Operate
  - Even if U/S equivocal (LOE: III) (Consensus BJUI 2004)
- U/S shows rupture
  - → Operate

**Testes: Blunt—Surgery**

- Indications:
  - Tunical rupture
  - Hematocele (Drainage)
    - Prevent testis ischemia, infxn, prolonged pain
    - LOE: III
    - @ UCSF: Expanding or > 5 cm (Buckley & McAninch JU 2006)
  - Intratesticular Hematoma
- Orchidectomy:
  - Scant viable parenchyma (massive injury)
**Testes: Blunt—Surgery**

- **Timing:**
  - Do not delay
    (↑ orchidectomy 3-8x)
  - Testicular salvage ↑ if explore < 3 days
    - 80-90% vs 32-45%
      (Gross 1969; Jeffrey 1983; Lupetin 1983)


**Testes: Surgery**

- Irrigation
- Debride necrotic/ extruded Semin. Tubules
- Close tunica albuginea (4-0 PDS)
- Tie off vas injuries w/ nonabsorbable suture for later repair
- Penrose drain
- ABx x 7 days

Consensus on Ext Genitalia Trauma. BJUI 2004.
**Testes: Nonoperative**

- Higher Orchidectomy rates
- Longer hospital stay  (McCormack 1966)
- Longer debility    (Cass JU 1983)
- Indication:
  - Scrotal injury w/ no testicular component
  - Intratesticular hematoma
  - 40% infection/necrosis requiring orchidectomy (Cass 1988)

**Testes: Penetrating**

- 2% of all civilian GSW
- Bilateral more common than in blunt (15x)
- Mx:
  - Exploration (92-97%)
    - Esp in equivocal cases
  - Salvage in 35-65%
  - Debride as much as 50% of ruined parenchyma & close capsule
Testes: Penetrating – Assoc Injuries

- Thigh (75%) – Femoral vessels?
- Penis (37%)
- Perineum (25%)
- Urethra (18%)
- Vas (10%)

Genital Skin Loss
Genital Skin Loss: Etiology

- Penetrating
  - Rare
  - Usually can close 1º-- up to 50% skin loss
- Burns
  - 1% of all burns
  - Usually Full Thickness
  - Mx:
    - Early resection burn eschar
    - STSG coverage

Genital Skin Loss: Burns

<table>
<thead>
<tr>
<th>Burn Type</th>
<th>Present Study</th>
<th>Peck et al</th>
<th>McDougal et al</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>55</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>Phasic</td>
<td>54</td>
<td>54</td>
<td>77</td>
</tr>
<tr>
<td>Others</td>
<td>20</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

(Michelsen JU 159:418, 1998)

- Electrical
  - Extensive damage
  - Mx:
    - Initially conservative
    - Glans: heal best by 2º intention (Wessells 1999)
- Chemical
  - Copious Irrigation
Genital Skin Loss: Etiology

- Constricting bands:
  - Pressure necrosis
  - Rarely significant skin loss
- Avulsion
  - Machinery (farm, industrial), Vacuums
  - Usually skin is torn free
- Bites

Genital Skin Loss: Bites
Genital Skin Loss: Bites—Mx

- Animal:
  - Dog most common; children
  - Most pts present immediately
  - Mx:
    - Irrigate/Debride & 1st Closure
      - 6-12 hrs (Fleisher NEJM 1999)
    - Empiric ABx:
      - Cephalexin or Amoxicillin-clavulanic acid
      - Penicillin V (Pasteurella multocida 20-25%) (LOE: II)
      - +/- Tetanus

Genital Skin Loss: Bites—Mx

- Human
  - Often delayed presentation
  - More likely gross infection
  - *Eikenella corrodens* most predominant
  - Mx:
    - Empiric ABx
    - Should not close 1st (LOE: III)

Genital Skin Loss: Staging

<table>
<thead>
<tr>
<th>Scrotum injury scale</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>Description of injury</td>
</tr>
<tr>
<td>I</td>
<td>Contusion</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt;25% of scrotal diameter</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt;25% of scrotal diameter</td>
</tr>
<tr>
<td>IV</td>
<td>Avulsion &lt;50%</td>
</tr>
<tr>
<td>V</td>
<td>Avulsion &gt;50%</td>
</tr>
</tbody>
</table>

From Moore et al [1]; with permission

Genital Skin Loss: Initial Mx

- Wet gauze dressing
- Silvadene for burns
- Daily inspection
- I&D infections until clean
- VAC dressings
  - After necrotic debris removed
  - May be helpful in complex, extensive wounds
Genital Skin Loss: Mx

• Penile or scrotal?
• Superficial vs Full thickness?
• Area of skin loss?
• Clean or infected?

Genital Skin Loss: Penis– OR

• Avoid using avulsed skin
• Options:
  • Scrotal flap (proximal loss)
  • Foreskin flap (distal loss)
  • Thick, Unmeshed STSG (thigh)
    • Meshed: ?Contracture
    • Meshed unexpanded: Acceptable cosmesis
  • Bulky cotton dressing w/ mineral oil x 5 days
  • Avoid intercourse x 6 wks
Genital Skin Loss: Penis – STSG

- STSG:
  - Better take
  - Less donor site morbidity
- Thickness
  - 0.018 inch preferred (McAninch 1984)
  - 0.014-0.016 inch acceptable
- Ventral zig-zag
  - Prevent longitudinal contracture
- Penile tightness resolves w/in 6 mo
- Un-Meshed (Standard)

Genital Skin Loss: STSG

- Meshed
  - Excellent graft take
  - Easier application
  - Pts w/ ED (McAninch 1989)
- Unexpanded (Black & Wessells 2004)
  - Acceptable cosmesis
  - No significant contractures
  - Preserved erections in potent pts

Genital Skin Loss: Scrotum

- <50% loss
  - Close acutely
- If Tunica vaginalis intact
  - Saline dressing
  - Options:
    - Close 1º
    - Meshed (2:1) STSG
    - Thigh flaps (esp if thigh pouches prev used)
- Thigh pouches if staged repair

Case: Female Urethra Trauma

- 4-6% of female pelvic #
- Clinical: Pelvic #, Blood @ introitus, vaginal lac
- Need vaginal exam!
- Investigations: Urethroscopy suggested
  - RUG, VCUG less helpful
Case: Female Urethral Trauma

- Mx guidelines: (Black & Wessells JU Jun 2006)
  - Proximal/BN: 1º repair
  - Mid-urethra:
    - Close 1º over urethral catheter
    - Repair vaginal lacerations
  - Distal: can leave hypospadiac
- If unstable:
  - SP catheter & delayed repair

Case: Female Urethral Trauma

- PTD 2 (OR):
  - Attempted urethroscopy
  - Antegrade cystogram, passed guidewire via SP
  - Angled ureteral catheter over guidewire
    - Through bladder neck to mid-urethral avulsion
    - Through-and-through access
  - Urethral foley, then SP catheter over guidewire
  - Repaired vaginal lacerations over catheter
Key Points—GU Trauma

- ABCs
- High index of suspicion
  - Associated injuries
- Assess extent of injury