Complex Genitourinary Trauma

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• Pediatric Surgeons of Phoenix
• Western Pediatric Trauma Conference
How am I so lucky to give this talk?

- Reproductive Anomalies/DSD Clinic at Phoenix Children’s Hospital
  - Pediatric Surgery
  - Pediatric Urology
  - Peds and Adolescent Gynecology
  - Endocrinology
  - Psychology
  - Genetics
Disclosures
Disclosures

• Not a trained Urologist
• Not a trained Gynecologist
Scope

- Blunt! (and a little penetrating)
  - Renal injury
  - Ureters
  - Bladder
  - Urethra
  - External Genitalia
  - Vagina/Perineum
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Focus

• Complex Reconstruction
  – What to do in the short term
  – Long term options for complicated injuries
  – Who to call and when
Incidence

• 2-5% of all trauma patients
• 10% of patients with abdominal trauma
• Includes renal trauma
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• Includes renal trauma

• Mechanisms
  – Wide variety
  – Pediatric: ATV, Auto vs Pedestrian, some penetrating
Injury to Ureter

- Uncommon
  - Less that 1% of patients with blunt mechanism
- Usually iatrogenic or secondary to penetrating trauma
- Commonly missed
- Spiral CT is rapid
  - Delayed excretory phase
- Cystoscopy with retrograde imaging
Ureter Injury Scale

- **I : Hematoma**
  - Contusion or hematoma without devascularization
- **II : Laceration**
  - <50% transection
- **III : Laceration**
  - >50% transection
- **IV : Laceration**
  - Complete transection with 2cm devascularization
- **V : Laceration**
  - Avulsion of renal hilum with devascularization
Management: Injury to Ureter

- Can’t go wrong with diversion

- Operative
  - Early – first 3 days

- Endoscopic
  - Stent

- Interventional
  - Percutaneous Nephrostomy
Management: Injury to Ureter

• Nonoperative management of disruption
  – Guidewire across injury
  – Conversion of nephrostomy tube to stent
  – Eventual capping to allow internal drainage
  – Up to 50% stricture rate

• May require delayed operative reconstruction
Case – injury to bladder

- 4 year old GSW to abdomen entry on abdomen (3 wounds)
- Exit on left buttock
- Stable, tachycardic
- Hemoglobin 8.4
- Exploration...
Case – injury to ureter

- Two injuries to small bowel
- Hematoma in sigmoid mesentery
- Exit site in pelvis
- Complete transection of left ureter
- Repaired over a stent, end to end
- Urology consulted postoperatively
- Stent removed at 3 weeks
Case – injury to ureter

• Reconstruction:
  – Mobilize ends and trim necrotic tissue
  – Back wall of interrupted 5-0 or 6-0 PDS
  – Place double J stent into bladder and renal pelvis
  – Front wall of sutures
Injury to Bladder

• Gross hematuria present in 95% of cases
• Associated pelvic fracture in 80%

• Rupture
  – Intraperitoneal
  – Extraperitoneal
  – Combined
Bladder Injury Scale

- I: Hematoma, Intramural
- I: Laceration, Partial thickness
- II: Laceration
  - Extraperitoneal Bladder laceration, <2cm
- III: Laceration
  - Extraperitoneal, >2cm
  - Intraperitoneal, <2cm
- IV: Laceration
  - Intraperitoneal, >2cm
- V: Laceration
  - Intra or Extraperitoneal extending to bladder neck or trigone
Management: Injury to Bladder

• Diagnosis: Stress cystography
  – Adequate filling of the bladder essential
  – 300-400 mL of iodinated contrast (30% iodine)

• CT stress cystography
  – Equivalent for defining and staging injury

• Extraperitoneal or Intraperitoneal?
Management: Injury to Bladder

• **Extraperitoneal**
  – Foley catheter (18-20 French in an adult)
  – 10-14 days
  – Repeat cystogram – 85% no extravasation
  – Leak? Recheck in 7-10 days
  – Still leaking? CT or cystoscopy to look for foreign body such as a piece of bone
Bladder Injury: Intraperitoneal Rupture

Radiographics, 2004
Management: Injury to Bladder

• **Intraperitoneal**
• Operative!
• Can find large, stellate tears
  – Sudden rise in pressure in full bladder...
Management: Injury to Bladder

• **Intraperitoneal**

• **Operative!**

• Can find large, stellate tears
  
  – Sudden rise in pressure in full bladder...

  – This is why your mother always tells you to go potty before you leave the house!
Operative repair of Bladder

• Midline incision
• Palpate inside the bladder – extend the laceration – Allis clamps
  – Identify ureteral orifices
• Two layer closure, PDS or vicryl
• Foley catheter drainage (5 to 10 days)
• Consider suprapubic tube
• Can get cystogram prior to tube removal
Case – bladder injury

• 6 year old male walking to school, in crosswalk
• Run over by a Uhaul truck turning right
• Brought in by ground
• Alert, complaining of pain in his “butt”
• Asking for a drink
Case – bladder injury

• In the trauma bay
  – Tachycardic
  – Abdomen distended
  – Expanding ecchymosis over pelvis
  – Pelvic binder placed
  – Transfused 2 units uncrossed matched
  – To CT
Case – bladder injury

- In CT
  - Still alert
  - Hypotensive
  - Quick Abdomen/pelvis only with delays
  - Called orthopedic surgery, urology and interventional radiology
  - To ICU
Case – bladder injury

• In ICU
  – Now decreased level of consciousness
  – Intubated
  – Central line and aline
  – Transfused with 2 units crossmatched blood
  – To OR
Case – bladder injury

• In OR
  – Discussion with all players (ortho, urology, IR)
  – General surgery...Tag! You’re it!
  – Midline incision
  – Gave anesthesia a heads up
  – Disrupted pelvic hematoma
  – Packed with laps and held pressure with retractors (student)
  – Found the bladder
Case – bladder injury

- Injury: Complete transection of the urethra at the level of the prostate
- Bladder lifted out of the pelvis by the hematoma
Case – bladder injury

• Reconstruction:

• Stage 1
  – Closed bladder over suprapubic tube

• Stage 2
  – Oversewed the bladder neck in the pelvis at the second look operation

• Stage 3 – a year or so from the injury
  – Continent urostomy (appendicovesicostomy)
Injury to Urethra

- Sudden compression against bony pelvis
- Pelvic fracture
- Blood at urethral meatus
- Inability to void
- Perineal hematoma
- Inability to palpate prostate on rectal exam
Bilateral Pubic Rami fractures...Urethral injury?

Radiographics, 2004
Urethral Injury Scale

• I : Contusion
• II : Stretch Injury
• III: Partial Disruption
  – Extravasation with contrast visualized in bladder
• IV: Complete Disruption
  – Extravasation, <2cm separation
• V : Complete Disruption
  – >2cm separation or extension into prostate or vagina
Management: Injury to Urethra

• Retrograde Urethrogram
  – Insert foley into distal urethra
  – 30cc of contrast

• Normal: Intact urethra with contrast entering bladder
  – Place Foley across injury

• Suprapubic tube if no contrast in bladder

• Avoid blind instrumentation

• Persistent hematuria: Stress cystogram
  – 10-15% of urethral injuries also have bladder injury
Case – multiple injuries

• 10-y-o female crossing I-94 near Detroit on the way to school (not at an overpass!)
• Run over by a semi-truck sustaining injury to pelvis
• Survival Flighted to ED, hypotensive, GCS 15
• Intubated, shear injury to lower extremities approximated
• Brought to OR for resuscitation and control of bleeding
Case: Damage Control

• Massive blood loss from lower extremities
  – Control of major bleeding vessels
• Brisk bleeding from perineum
• Urethral opening disrupted
• Lower midline, bladder opened, bone protruding into bladder, suprapubic tube
• Repair of vaginal laceration

• Return to OR for cystoscopy, placement of transurethral catheter, debridement of extremity wounds
Case – multiple injuries

• Multiple delayed reconstructions
  – Pelvic fracture fixed
  – Extremity wound management with skin grafts
  – Vaginal laceration healed with no stricture
  – Urethral reconstruction with eventual removal of tubes
  – Buttock prosthesis for tissue loss
Case

- Reconstruction:
  - Female urethral injury
  - Rarely a complete disruption
  - Can suture primarily if done early
  - Low stricture rate
Injury to External Genitalia: Male

- Diverse groups of mechanisms
- “Penile Fracture”
- Crush injuries (auto vs pedestrian)
  - Tissue crushed against bony pelvis
- Blunt trauma to scrotum
- Penetrating trauma to scrotum
  - Gunshot wound
  - Dog bite
Injury to External Genitalia: Male

• Operative exploration
  – Urologist if available

• Cystogram
  – Damage to urethra

• Ultrasound
  – Location of hematoma
  – Testicular viability
Anatomy
Warning: some of these images are not for the faint of heart. Sorry.
Penile Fracture – Eggplant sign
Degloving injury

- 5 year old male
- Fell out of a tree
- Slid down a tree trunk?
Penetrating trauma

- 14 year old male self-inflicted gunshot wound to scrotum with bullet lodged in left thigh
- Pale, tachycardic, GCS 15
- No active bleeding from thigh wound
- Expanding hematoma at base of scrotum
- No blood at meatus
Penetrating trauma
Penetrating trauma

• OR
  – Cystoscopy, no obvious injury to urethra
  – Evacuated hematoma through wound at base of scrotum
  – Brisk bleeding, not easily controlled with pressure
• Reconstruction
  – Raised skin flaps
  – Closed with three layers of vicryl, interrupted and running
Penetrating trauma
Dog bite

• Child left unattended in a rocker swing
• Pitbull puppy interested in the diaper
• Child found on the floor with scrotal laceration
• History of bilateral undescended testes
Dog bite – scrotal injury

• Reconstruction:
• Found two blind-ending vas deferens
• Wound irrigated and closed

• Needs testicular prosthesis
• Needs hormonal replacement
Perineal (Straddle) Injuries

• “Don’t climb on the kitchen counter!”
• Complete examination
  – In OR for prepubescent girls
  – Injury can be more severe than anticipated
• Hematoma >5cm
  – Consider Incision/drainage
• Lacerations
  – Irrigate and debride
  – Repair in layers
Vaginal Injuries

• Bleeding!
• Temporary packing
  – Usually ineffective in controlling hemorrhage
• Operative repair of lacerations
• Simple running suture
• Lateral wall injuries, may find bleeding vessels

• Good long term outcome
Case – vaginal injury

- 18 year old female, climbing over a fence to get in the back door of a bar
- Impaled on sign post
- Brought to ED, no story
- Perineal wound, OR for EUA
- Becomes unstable
Case – vaginal injury

- OR findings
  - Laceration through rectum
  - Anterior and posterior vagina lacerations
  - Mesenteric laceration with hemorrhage and small bowel injury
  - Laceration through left hemidiaphragm
  - Diverting ileostomy, primary repair of intestinal and vaginal lacerations
  - Open abdomen, multiple surgeries
Case – vaginal injury

- Course:
  - Studied prior to ostomy takedown
  - Found to have rectovaginal fistula
  - Treated first with advancement flap

- Fistula recurred
Case – vaginal injury

• Reconstruction:

• Gracilis-flap interposed between rectum and vagina

• Ostomy takedown

• Sexually active
When to call the Consultants

• Early and often

• Availability in damage control laparotomy
• Management of long term reconstruction and outcomes

• Urology, Gynecology, Plastic Surgery
Thanks.