

Campbell's Club: Lower Urinary Tract Trauma

Danish Singh

Framework of Trauma

- Penetrating, Blunt, Iatrogenic
- Anatomical Considerations
- Concomitant Injuries
- Imaging
- Decisions for immediate vs delayed operative intervention

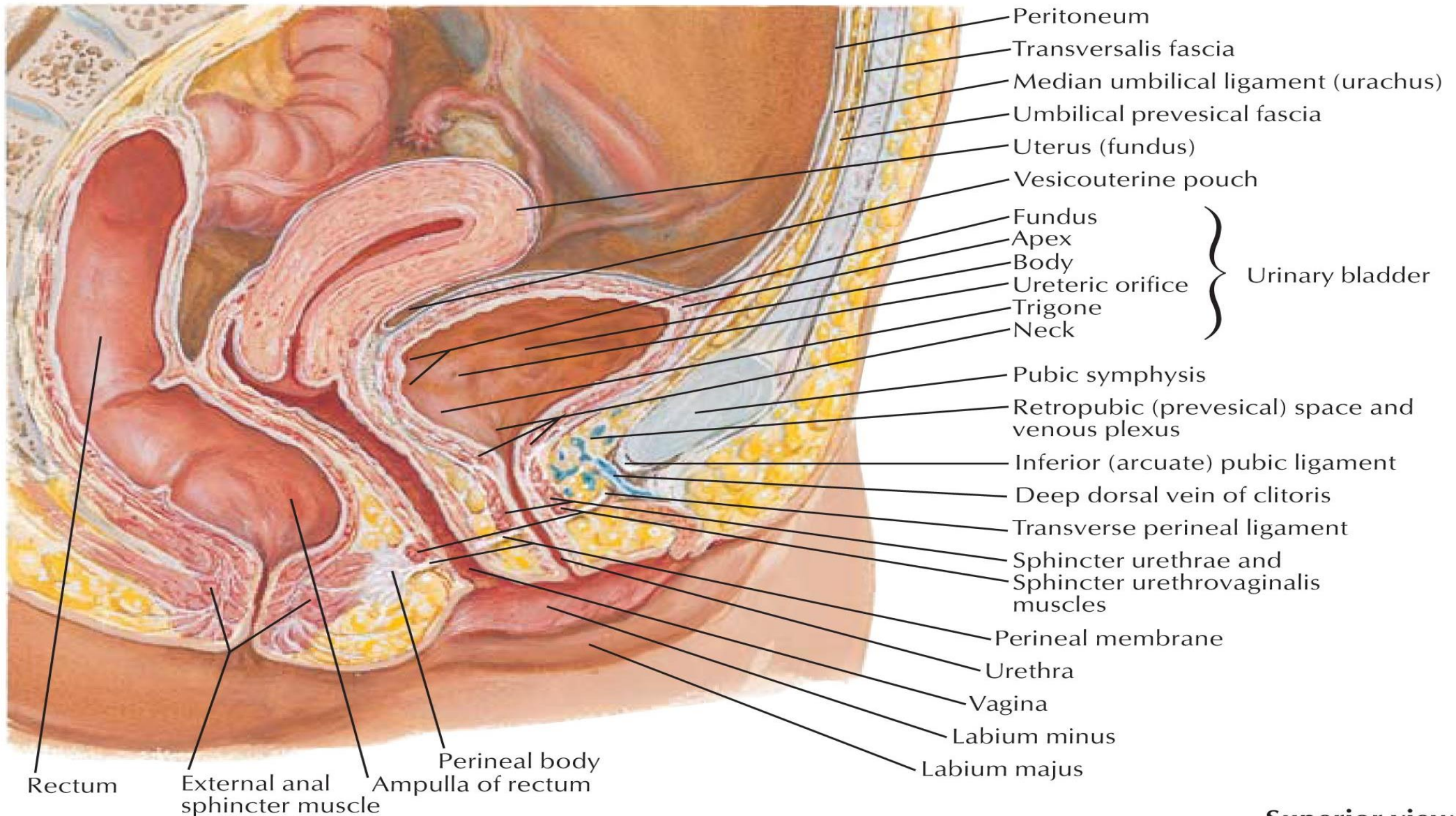
Bladder Trauma

- Epidemiology
 - 2nd most common GU organ involved
 - 10% of all GU injuries
- Blunt mechanism:
 - 80-85% of all bladder injuries
 - 83-95% of blunt injuries accompanied by a pelvic fracture
 - Note only 2-11% of all pelvic fractures result in bladder injury
- Penetrative Mechanism:
 - GSW most common
- Iatrogenic: pelvic surgeries
- Mechanism can alert to possible bladder injury

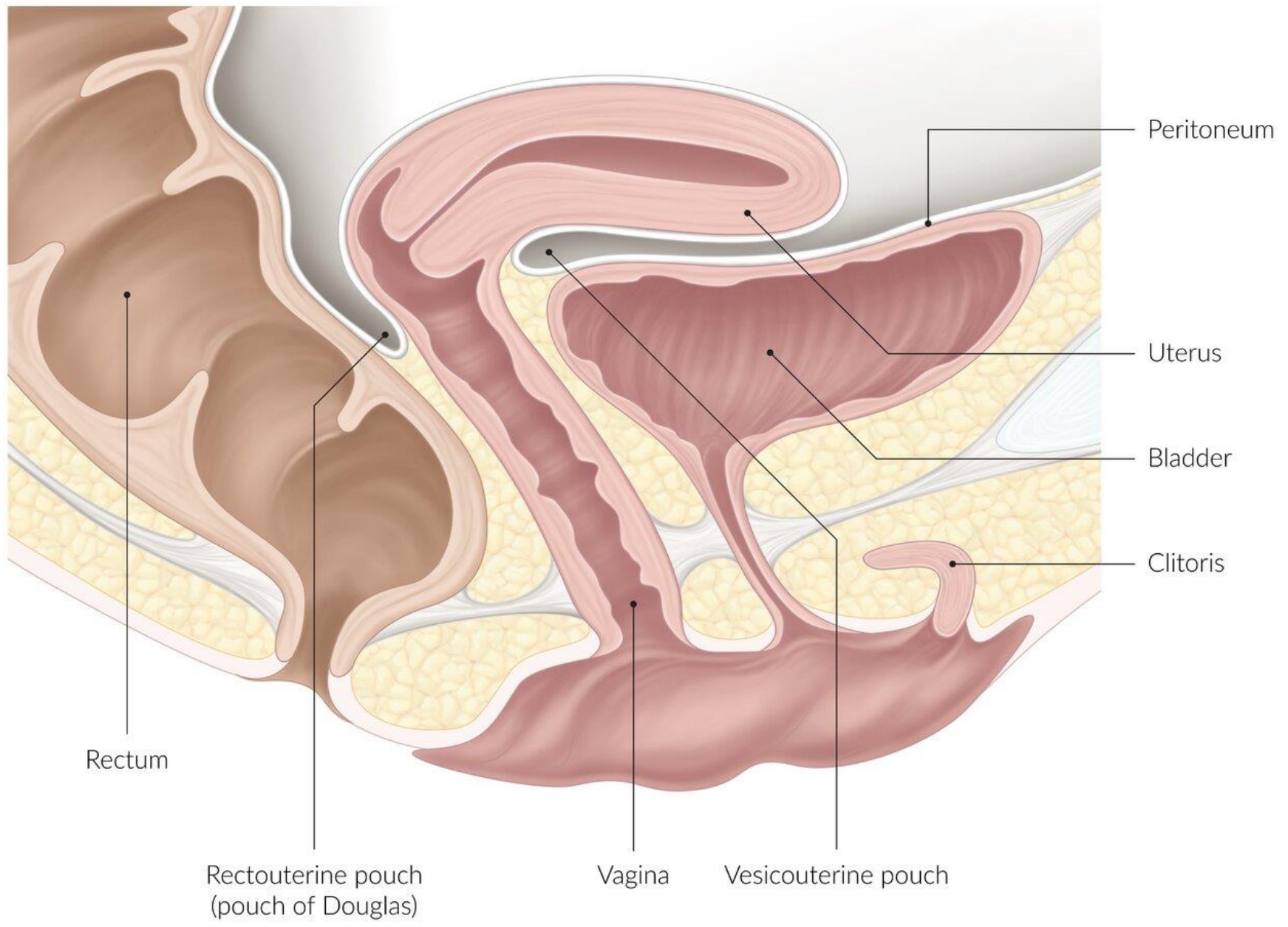
Bladder Anatomy

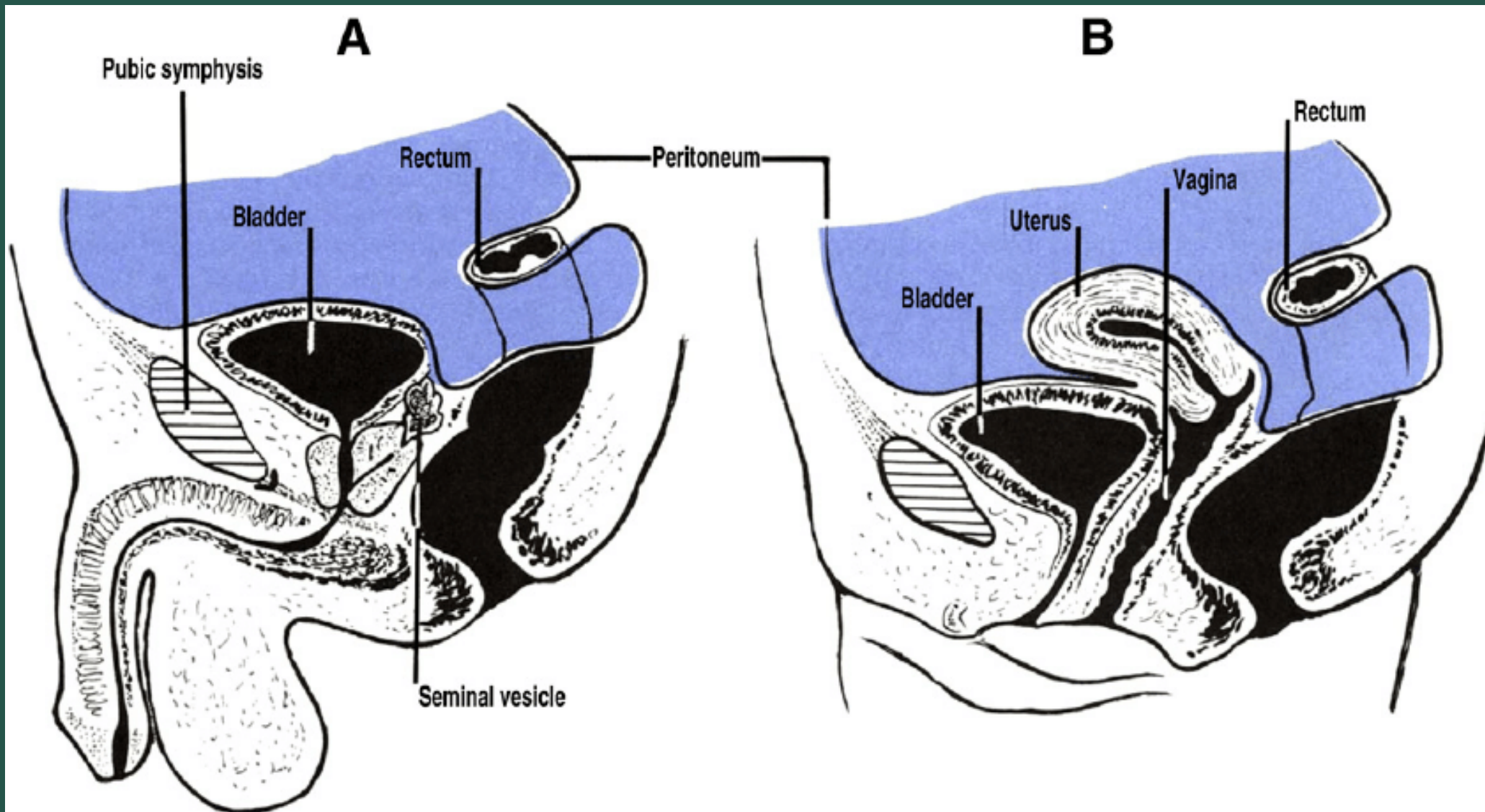
- Embryologically: UG sinus –endoderm, Trigone – mesonephric ducts mesodermal structure, ureteral bud- ureters
- Urothelium and 3 muscular layers
- Peritoneal reflections:
- Dome of bladder covered by parietal peritoneum as it reflects off anterolateral abdominal walls. Females this is contiguous w/anterior surface uterus and ant leaf broad ligament
- Urachus enters posteroinferiorly
- Arterial:
 - Superior and inferior vesical arteries – anterior branch of internal iliac
 - Smaller branches inferior gluteal and obturator
 - Uterine and vaginal arteries also supply in females
- Venous: internal iliac veins

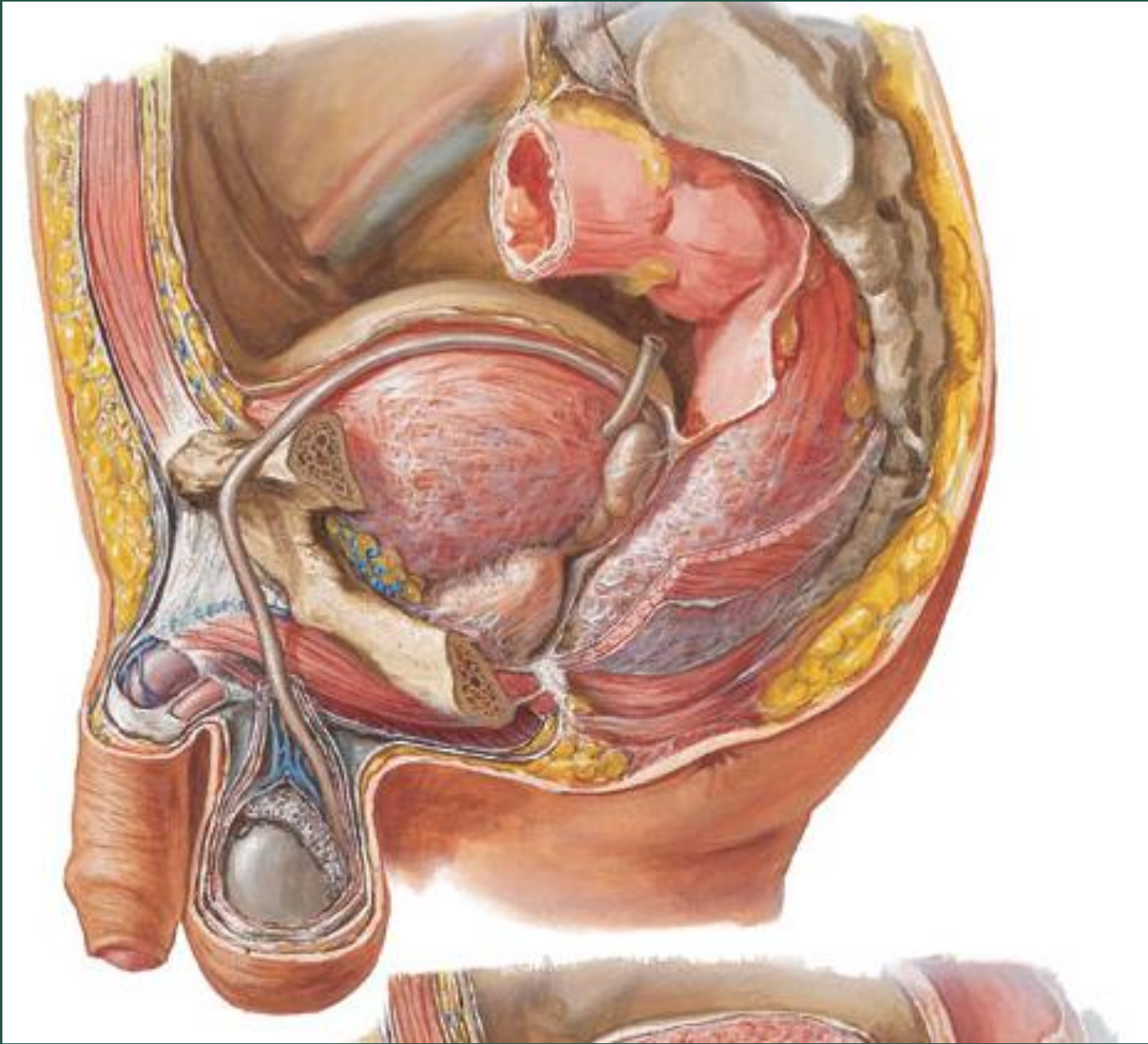
Female: midsagittal section

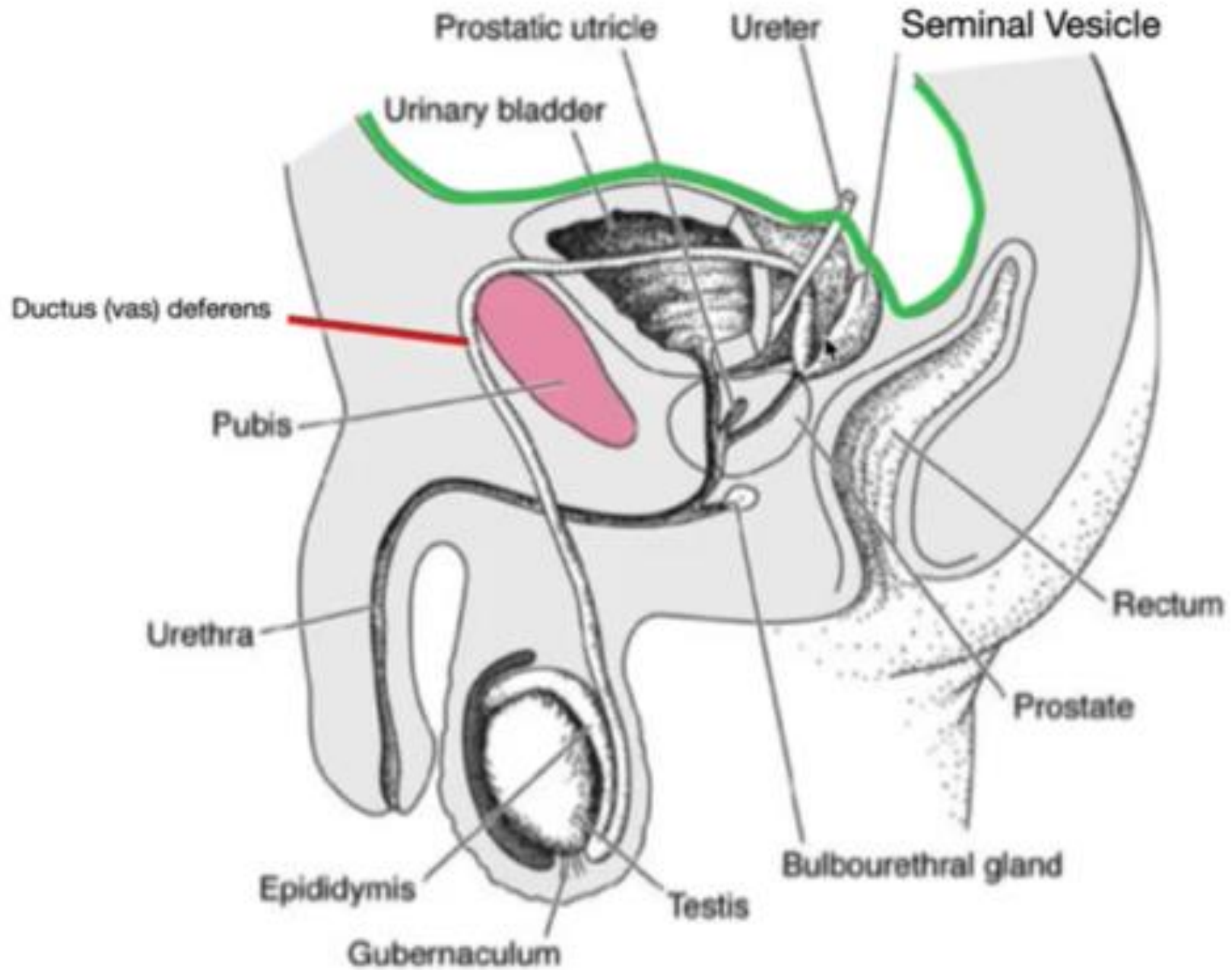


Superior view with









Presentation

- Gross hematuria most common presenting sign
 - In blunt force trauma Pelvic Fracture + Gross Hematuria : 16-27% cases of bladder rupture
- MH in blunt force trauma and no other LUT injury = unlikely bladder injury – no cystogram
- Penetrating trauma: no GH always. Rely on trajectory not sx to address if eval needed

Imaging

- Stress Cystogram (300-400cc, 3 views)
- CT Cystogram done w/adequate bladder distension same sensitivity and specificity
- Can consider intraop cystoscopy to dx subtle injuries, bullet fragments and bone fragments.
- When should I consider a rug? – anterior pelvic ring fx (inferior rami and pubic symphysis diastasis to evaluate urethra)
- Skip if HDS or intraop complication/injury

Immediate vs Delayed repair:

- Immediate repair:
 - Intraperitoneal Leak – dx and repair intraperitoneal leak at dome and superior bladder. **For severe blunt force trauma do NOT explore space of retzius or deep retroperitoneum due to risk exsanguination from deep pelvic veins**
 - Absorbable sutures- multiple layers
 - Closed suction drain
 - SPT +/- depending if uncomplicated repair
 - Flap +/-
 - Extraperitoneal Leak with signs of the following:
 - Bladder neck
 - Urethral injury
 - Inadequate drainage w/catheter
 - Vaginal
 - Rectal
 - Massive pelvic trauma
 - Protruding bone fragments or intraluminal bullet fragments
 - Penetrating Injuries
 - Orthopaedic injuries in setting of bone hardware
- Delayed repair: Small extraperitoneal injuries w/out above contraindications

Complications

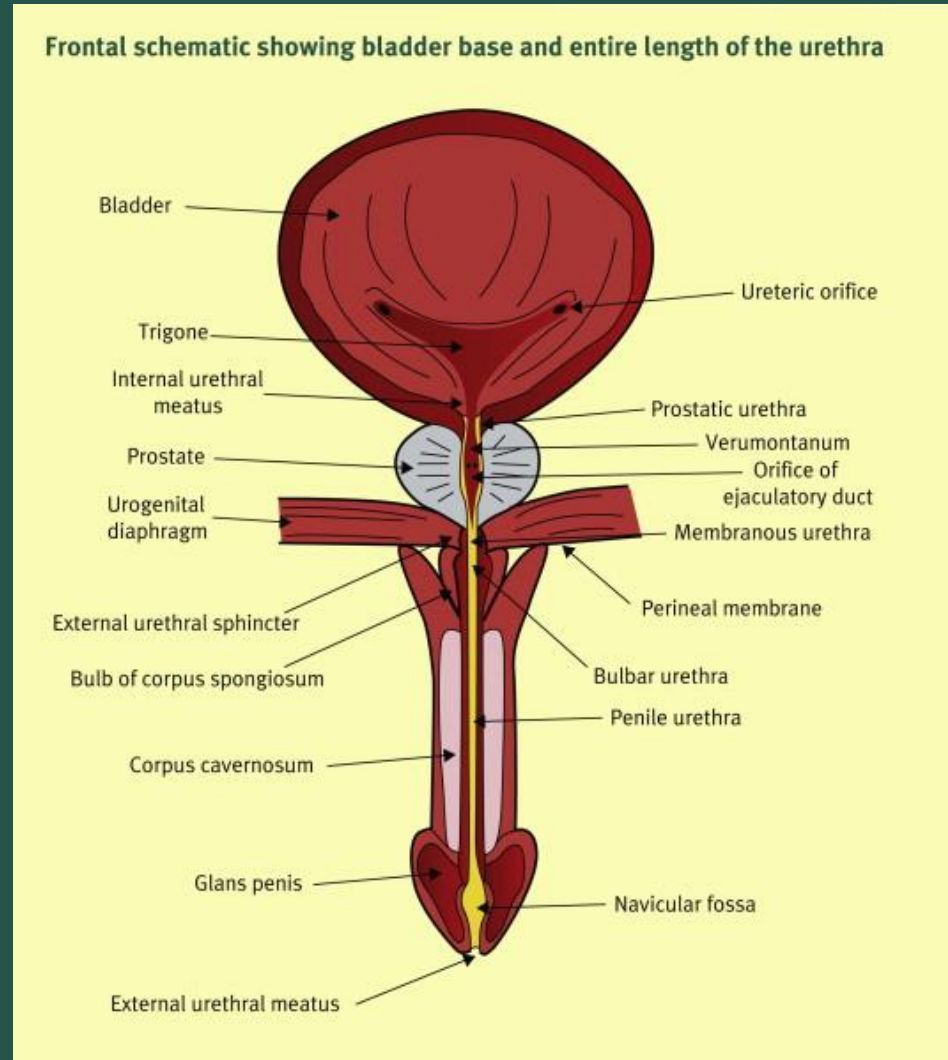
- Persistent leak most common
 - Evaluate for bony spicules or foreign body
- Fistulae

Urethral Injuries

- Epidemiology:
 - 4% of all GU trauma
 - Mainly blunt trauma
 - Anterior vs Posterior urethra
 - Mainly Men impacted
- Blunt injuries: Contusion, and avulsions.
- Penetrating injuries: Laceration, transection, and blast injury with delayed stenosis.
- Iatrogenic: Result from endoscopic injuries and instrumentation. These range from minor mucosal abrasions to lacerations and penetrations, and thermal injury.
- Anterior vs Posterior Urethra

Urethral Anatomy

- Arterial Supply
- Internal Pudendal > Common Penile Artery > Bulbourethral Artery
- Bulbourethral arteries arborize in glans and provide retrograde perfusion to urethra when bulbourethral arteries are transected
- Small perforating arteries that pass through corporal bodies



Urethral Injury Etiology

- **Posterior Urethra:**
 - Membranous and Prostatic urethra is related to bony pelvis, need to consider w/fx
 - 3-6% pelvic fx posterior urethral injury
 - Stretching/shearing bulbomembranous disruption
- **Anterior Urethra**
 - Bulbar Urethra most commonly injured 85% of injuries
 - Straddle Type fall or direct blow
 - Penile fx can cause injury to urethra traversing corpus spongiosum
- **Penetrating:**
 - 3% GSW's to GU system involve anterior urethra
 - 40-50% penetrating wounds to penis have urethral injury
- **Iatrogenic**

Urethral Injury Presentation

- Anterior Urethra:
 - Blunt Urethral injury: straddle or blow to perineum
 - Mid-perineum where urethra is crushed against the pubic arch
 - Distal pendulous urethral injury: Penis crushed against pubic symphysis
- Posterior Urethral injury
 - Blood at meatus, Inability to void, pelvic fx
 - 15% Bladder Injury
- Female Urethral Injury
 - 0-6% patients w/pelvic fx
 - Hematuria, Vaginal Laceration, Labial edema, urethrohhagia

Physical Exam

- Blood at meatus (37-93%)
- Bulbar urethral injuries: perineal hematoma
 - hematoma can have a classic appearance of a butterfly within the perineum, due to rupture of Buck's fascia, and can spread into the scrotum or up the abdomen along the layers of Dartos and Scarpa's fascia.
- Posterior urethral injury: high riding ballotable prostate
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Imaging

- RUG
- Dramatic bloom of urinary contrast extravasation at either the bulbomembranous junction or the prostatic apex in patients with complete urethral transection.
- CT Cystogram to r/o bladder injury
- Specific fractures associated with a greater risk of urethral injury are pubis symphysis diastasis and inferior pubic rami fracture, especially in the medial aspect of the rami.⁴⁰
- Cystoscopy +/-
- Anoscopy +/-

Urethral Management

- Anterior Urethral Injury:
 - Blunt: catheter
 - Penetrating: Small- primary repair, extensive urinar diversion
- Posterior Urethral Injury
 - SPT –percutaneous or open
 - Almost NEVER primarily repair unless bladder neck injuries or extension of bladder /bladder neck injury into prostatic urethra's anterior portion
- Female Urethral injury: always repaired unless HD unstable
 - Distal female urethra delayed or formalized and made hypospadiac
- ED, Incontinence, Urethral

Genital Trauma

- Epidemiology:
 - 26-68% pts w/GU system have injuries to external genitalia
 - Majority trauma is blunt
 - Penetrating trauma 40-60% to GU involve ext genitalia
- Blunt injuries: Contusion, avulsion, and burns
- Penetrating injuries: Laceration, amputation, and bites

Genital Anatomy

- Male genital structures connected to the body through the anterior peritoneum
- Scrotum – anterior apex of triangle, colles fascia
- Root of penis connected to medial aspect of colles fascia
- Arterial supply: internal pudendal and testicular arteries
- Lumbosacral plexus

Penile Injuries

- Blunt:
 - Penile Fractures – cracking/popping immediate detumescence pain and penile swelling. Eggplant sign. If blood at meatus – urethral injury.
 - Always repair surgically, no room for delayed management *unless* xiaflex
- Penetrating:
 - GSW
 - Stab wounds
 - 54-80% other nonurologic injuries
 - Urethral injury very common
- Amputation
 - Self inflicted

Testis Injuries

- Blunt trauma:
 - Testis protected normally by tunical albuginea and retractile nature of cremasteric muscles
 - Contusion to parenchymal loss
 - 50-85% testicular injuries
 - Ecchymosis, swelling or hematoma
- Penetrating
 - Less common
 - 30% bilateral and 80% other injuries
 - 40-60% penetrating scrotal wounds have testicular injury

Scrotum Injuries

- Mainly burn, mechanical shearing injury
- Penetrating injury mainly due to bites

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Imaging?

- Penile:
 - Blunt: Penile US or MRI can eval corpora, RUG and/or cysto for hematuria/inability to void
 - Penetrating: RUG or if this will delay, cysto in operative setting
- Testis:
 - Blunt: SCROTAL US is paramount
 - Penetrative: Exploration, urethral, bladder and rectal eval

Management

- Penile:
 - Blunt: Prompt surgical exploration and repair for fx.
 - Penetrating: Surgical repair immediately w/debridement
 - Amputation: Amputated segment in saline soaked gauze, in plastic bag on ice, Repair in 24 hours, macroscopic repair and can consider microsurgical repair if available of dorsal vascular and nerve structures. If appendage not available close as w/partial penectomy.
- Testis:
 - Blunt: Testicular fracture or hematoma: scrotal exploration and repair
 - Penetrative: Surgical exploration
- Scrotal: open wounds, cleansing and debridement. Consider diversion if urine and fecal stream involved