Urology Final

🔊 **Podcast Style Review (Experimental Feature)**

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- **NOTE:** Highlighted in **bold** are the important key info!
- Topics are arranged in order of most to least commonly tested
- Check the table of contents below for easier navigation
- Good luck 🍀

1. Prostate (BPH & Cancer)

Benign Prostatic Hyperplasia (BPH)

- **Pathophysiology & Symptoms:**
    - Originates primarily from the **transitional zone**.
    - Causes **obstructive** (hesitancy, weak stream, incomplete emptying, dribbling, straining) and **irritative** (frequency, urgency, nocturia) symptoms (LUTS).
    - Dysuria is **not** a classical symptom of BPH itself.
    - Can lead to complications like **urinary retention** (acute/chronic) and **ascending UTIs** (→ epididymitis).
    - Chronic retention can lead to **renal function deterioration**.
- **Diagnosis:**
    - **Digital Rectal Exam (DRE)** is routine to assess size, consistency, and check for nodules.

    - **PSA** testing is common but not specific to BPH.
    - **IPSS** (International Prostate Symptom Score) quantifies symptom severity. (Incontinence is **not** part of IPSS).
    - **Urine analysis** is standard.
    - Tests **not** routinely done for initial diagnosis: Transrectal Ultrasound (TRUS), Urodynamic studies (unless neurogenic suspicion/failed treatment), Cystoscopy (unless hematuria/other indications), Urine cytology (no diagnostic value for BPH).
- **Treatment:**
    - Observation/Watchful Waiting for mild symptoms.
    - **Alpha-1 blockers** (e.g., Tamsulosin, Terazosin, Doxazosin) for symptom relief.
        - **Tamsulosin** is **uro-selective** (alpha-1a subtype).
    - **5-alpha-reductase inhibitors** (e.g., Finasteride) reduce prostate size, **prevent progression**, and reduce risk of retention. Take months to work.
    - **TURP (Transurethral Resection of the Prostate)** is indicated for:
        - Moderate-severe LUTS refractory to medical therapy.
        - **Complications:** recurrent retention, **deteriorating renal function**, recurrent UTIs, bladder stones, gross hematuria.
    - Radical prostatectomy is **NOT** a treatment for BPH.
- **BPH is NOT a risk factor for prostate cancer.**

Prostate Cancer

- **Diagnosis:**
    - **Definitive diagnosis is by core needle biopsy**, usually guided by TRUS.
    - Suspicion raised by **nodular DRE** or **elevated PSA**.
    - PSA is **prostate-specific, not cancer-specific**. Elevated also in BPH, prostatitis, trauma, instrumentation.
    - MRI can be used in the diagnostic algorithm (e.g., multiparametric MRI before biopsy or if PSA remains high without clear DRE findings).
- **Pathology & Staging:**
    - Most are adenocarcinomas.
    - **Absence of basal cell layer** is characteristic (unlike BPH).
    - Precursors: Prostatic Intraepithelial Neoplasia (PIN), Atypical Small Acinar Proliferation (ASAP).
    - Bone metastases are typically **osteoblastic**.
- **Treatment:**
    - Treatment depends on stage, grade, patient factors.
    - **Anti-androgen therapy (hormonal therapy)** is the mainstay for **metastatic disease**.
    - Radical prostatectomy is an option for localized disease.
- **Screening:** Involves DRE and PSA. Observation is an option if PSA is normal, DRE is normal, and repeat PSA is stable.

Prostate Anatomy & Physiology

- **Blood Supply:** Primarily from the **inferior vesical artery**.
- **PSA (Prostate-Specific Antigen):** An enzyme produced by prostate epithelial cells.

2. Scrotal Pathologies

- **Testicular Torsion:**
    - **Surgical emergency**. Twisting of spermatic cord cuts off blood supply.
    - **Sudden onset** of severe testicular pain, often with nausea/vomiting.

    - High-riding testis, **absent cremasteric reflex**.
    - Most common in ages **10-30 years**.
    - Diagnosis is **clinical**. Doppler US may be used if diagnosis uncertain, but shouldn't delay exploration.
    - Treatment: **Immediate surgical exploration of BOTH testes**, detorsion, and **bilateral orchiopexy** (fixation). Manual detorsion is temporary/if OR unavailable.
- **Epididymitis/Epididymo-orchitis:**
    - Inflammation of epididymis +/- testis.
    - **Gradual onset** of pain, swelling, redness, warmth. Fever common.
    - Often associated with UTI or STIs. Can be complication of BPH obstruction.
    - Cremasteric reflex usually present. Prehn's sign (relief with elevation) may be positive.
    - Diagnosis aided by **Scrotal Ultrasound**.
    - Treatment: **Antibiotics** (covering likely pathogens based on age/risk factors), rest, scrotal support, analgesia. **Admission for IV antibiotics** if severe (e.g., high fever, signs of sepsis).
- **Varicocele:**
    - Dilated veins of pampiniform plexus. **More common on the left side**.
    - Often asymptomatic, may cause dull ache/heaviness, "bag of worms" feel.
    - Associated with **male subfertility**. **Most common surgically correctable cause**.
    - Grading based on palpability/visibility with/without Valsalva.
    - Treatment (ligation/embolization) indicated for **pain, infertility**, or testicular atrophy. **Grade alone does not mandate surgery**.
    - **Ilioinguinal nerve** is at risk during surgical repair.
- **Hydrocele:**
    - Fluid collection between layers of tunica vaginalis.
    - Painless scrotal swelling, transilluminates.
    - Treatment: Observation (especially in infants, often resolves). Surgical excision (hydrocelectomy) if large, symptomatic, or persistent in adults.
- **Spermatocele:**
    - Benign retention cyst of sperm, arising from epididymis/rete testis. Usually superior/posterior to testis.
    - Usually asymptomatic.
    - Treatment: Observation unless large/symptomatic, then spermatocelectomy.
- **Undescended Testis (Cryptorchidism):**
    - Failure of testis to descend into scrotum.
    - Associated risks: **Infertility**, **testicular cancer** (risk increased 40-fold), torsion, hernia.
    - Treatment: **Orchiopexy**, ideally performed **before 1 year of age (e.g., 6-12 months)** to maximize fertility potential and facilitate cancer surveillance.
- **Testicular Anatomy:**
    - **Blood Supply: Testicular artery** (from aorta, below renal artery). Venous drainage via pampiniform plexus → testicular vein (Left to L renal vein, Right to IVC).
    - **Lymphatic Drainage: Para-aortic nodes**.
    - **Development:** Descent influenced by gubernaculum, testosterone, intra-abdominal pressure.

3. Stones (Renal & Ureteral)

- **Types & Composition:**
    - **Calcium Oxalate: Most common type**. Radio-opaque.

    - Calcium Phosphate: Radio-opaque.
    - Struvite (Magnesium Ammonium Phosphate): Associated with UTI (urease-producing bacteria like Proteus). Can form staghorn calculi. Relatively radiolucent.
    - **Uric Acid: Radiolucent**. Associated with acidic urine pH, gout.
    - Cysteine: Rare, genetic. Relatively radiolucent.
    - Indinavir: Radiolucent.
- **Clinical Presentation:**
    - **Renal Colic: Sudden onset, severe flank pain**, may radiate to groin/testicle/labia. Nausea/vomiting common. Hematuria (microscopic or gross).
    - Non-obstructing renal stones may be asymptomatic or cause dull flank pain.
    - Bladder stones: Suprapubic pain, frequency, urgency, hematuria, poor flow.
- **Diagnosis:**
    - **Non-contrast Helical CT scan** is the **gold standard** for diagnosis.
    - KUB X-ray: Can see radio-opaque stones (Calcium), limited use for radiolucent.
    - Ultrasound: Useful for hydronephrosis, less sensitive for ureteric stones.
- **Management:**
    - **Acute Colic:** Pain management (NSAIDs, opioids), hydration.
    - **Medical Expulsive Therapy (MET):** For stones **<5-10mm** (especially distal ureter), using alpha-blockers (e.g., tamsulosin). Wait 1-2 weeks.
    - **Indications for Urgent Intervention/Decompression (JJ stent or Nephrostomy tube):**
        - **Infection (Pyelonephritis/Fever)** with obstruction - **PRIORITY IS DECOMPRESSION & ANTIBIOTICS**.
        - **Solitary kidney** with obstruction.
        - Bilateral obstruction.
        - Intractable pain or vomiting.
        - Renal failure.
    - **Definitive Stone Treatment:**
        - **ESWL (Extracorporeal Shock Wave Lithotripsy):** Good for renal stones <2cm, upper ureteric stones. Not for very hard stones (cysteine) or radiolucent stones.
        - **Ureteroscopy (URS) with Laser/Pneumatic Lithotripsy:** Preferred for **mid and lower ureteric stones**. Can be used for upper ureter/renal stones (flexible URS). **Rigid URS** is common for mid/distal stones.
        - **PCNL (Percutaneous Nephrolithotomy):** For **large renal stones (>2cm)**, staghorn calculi, lower pole stones >1.5cm.
        - **JJ Stent:** Used temporarily to relieve obstruction, allow healing after URS, or prevent obstruction from fragments post-ESWL.
    - Size/Location Guidance (General):
        - <5mm: Likely pass spontaneously, consider MET.
        - 5mm-1cm Ureter: MET, ESWL (upper), URS (mid/lower).
        - 1-2cm Kidney: ESWL (DJ stent often placed), Flexible URS, PCNL (especially lower pole).
        - 2cm Kidney: **PCNL**.
        - Mid-ureter stone (e.g., 9mm): **Rigid URS + JJ stent**.
- **Prevention:** Increase fluid intake. Dietary modification based on stone type. Citrate inhibits calcium stone formation by complexing with calcium.

4. Hematuria

- **Definition:** Presence of red blood cells in urine.

    - Gross: Visible blood.
    - Microscopic: >3 RBCs per high-power field on microscopy.
- **Significance:**
    - **Painless gross hematuria in adults >35 years old is considered malignancy (bladder, renal, urothelial) until proven otherwise.** Smoking is a major risk factor.
    - Hematuria vs. Hemoglobinuria: Differentiated by **microscopy showing RBCs**.
- **Etiology (Timing):**
    - Initial: Urethral source.
    - Terminal: **Prostate, bladder neck**, bladder stone.
    - Total: Bladder or upper tract (kidney/ureter).
- **Workup:**
    - **Essential components for significant hematuria (gross, or persistent/high-risk microscopic):**
        - **Upper Tract Imaging: CT Urogram** (CT with and without contrast + delayed phase) is preferred study.
        - **Lower Tract Evaluation: Cystoscopy**.
        - **Urine Cytology:** Looks for malignant cells.
    - **Anticoagulation is NOT a reason to skip workup.** Hematuria in anticoagulated patients needs full evaluation.
    - Cystoscopy is necessary even if CT or cytology is negative in high-risk patients or those with gross hematuria.
- **Common Causes:** UTI, stones, BPH, malignancy (bladder, kidney, prostate, ureter), trauma, glomerular disease (nephrology workup needed), strenuous exercise. Bladder instability does **not** typically cause hematuria.

5. Incontinence & Urodynamics

- **Types of Incontinence:**
    - **Stress Urinary Incontinence (SUI):** Leakage with increased intra-abdominal pressure (cough, sneeze, laugh). Due to urethral hypermobility or intrinsic sphincter deficiency. Risk factors: age, vaginal delivery, obesity, pelvic surgery.
    - **Urge Urinary Incontinence (UUI):** Leakage preceded by or associated with urgency. Due to **detrusor overactivity (involuntary bladder contractions)**.
    - **Mixed Incontinence (MUI):** Combination of SUI and UUI.
    - **Overflow Incontinence:** Leakage (often dribbling) due to incomplete bladder emptying and high residual volume. Caused by **detrusor underactivity** or **bladder outlet obstruction** (e.g., BPH, stricture). Often presents as **frequent, involuntary intermittent dribbling without urge**, may have **palpable bladder**.
    - **Total/Continuous Incontinence:** Continuous leakage. Suggests **fistula** (e.g., vesicovaginal) or complete sphincter incompetence.
    - Functional Incontinence: Inability to reach toilet due to physical/cognitive impairment.
- **Overactive Bladder (OAB):** Syndrome of **urgency**, usually with frequency and nocturia, **with or without urge incontinence**. Associated with **involuntary detrusor contractions**.
- **Neurogenic Bladder:** Bladder dysfunction due to neurologic disease (spinal cord injury, MS, Parkinson's, stroke). Can cause retention or incontinence (spastic or flaccid bladder).
    - **Pontine Micturition Center** coordinates detrusor contraction with external sphincter relaxation. Lesions above this can cause detrusor-sphincter dyssynergia. Onuf's nucleus controls external sphincter.
- **Evaluation:**
    - History, bladder diary, physical exam (including neuro, pelvic).
    - Urine analysis, urine culture.
    - **Post-Void Residual (PVR)** measurement (ultrasound or catheter).
    - **Cystoscopy** is **not** a routine part of initial workup unless hematuria, recurrent UTIs, suspicion of fistula/stricture/stone/tumor.

- Urodynamic studies: Used for complex cases, uncertain diagnosis, prior to surgery.

- **Management:** Behavioral therapy (bladder training, pelvic floor exercises), medications (anticholinergics/beta-3 agonists for UUI/OAB), surgery (slings for SUI), management of underlying cause (e.g., TURP for BPH causing overflow).

6. GU Trauma

- **Renal Trauma:**
  - Most common mechanism is blunt trauma (RTA, falls, kicks).
  - Graded I-V based on severity (AAST scale).
    - Grade 1: Contusion/subcapsular hematoma, no laceration.
    - Grade 2: Laceration <1cm, non-expanding perirenal hematoma.
    - Grade 3: Laceration >1cm, no urine extravasation.
    - Grade 4: Laceration into collecting system (urine extravasation) OR segmental vascular injury.
    - Grade 5: Shattered kidney OR renal pedicle avulsion/thrombosis.
  - **Imaging: CT scan with IV contrast and delayed phase** is the study of choice for suspected significant renal injury.
  - **Management:**
    - **Most blunt renal trauma (Grade I-IV) in hemodynamically stable patients is managed non-operatively** with admission, bed rest, serial monitoring.
    - **Indications for exploration/intervention:** Hemodynamic instability, expanding/pulsatile hematoma, Grade V vascular injury.
  - Occlusion of a **segmental renal artery** causes **segmental renal infarction** (kidneys have end arteries with no significant collateral circulation).
- **Bladder Trauma:**
  - Often associated with pelvic fractures.
  - Cardinal sign: **Gross hematuria**.
  - **Imaging: CT Cystogram** or conventional cystography is diagnostic tool of choice.
  - Types:
    - **Extraperitoneal Rupture:** More common. Urine leaks into pelvic extraperitoneal space. Management: **Catheter drainage (urethral or suprapubic)** usually sufficient. Surgery needed if bladder neck involved, bone fragments in bladder, or concomitant rectal injury.
    - **Intraperitoneal Rupture:** Urine leaks into peritoneal cavity. **Requires surgical repair (laparotomy)**.
- **Urethral Trauma:**
  - Associated with pelvic fracture (posterior urethra) or straddle injury (anterior urethra).
  - Signs: Blood at meatus, inability to void, high-riding prostate (posterior).
  - **Diagnosis: Retrograde Urethrogram (RUG)** is gold standard. **Avoid urethral catheterization until injury ruled out/defined by RUG**.
  - Management: Initial **suprapubic cystostomy** for drainage. Delayed repair often preferred for posterior injuries. Anterior injuries may sometimes be repaired primarily or managed initially with catheter realignment. Small bulbar strictures may be treated with optical urethrotomy.
- **Testicular Trauma:**
  - Blunt or penetrating.
  - Ruptured testis requires **surgical exploration and repair/orchiectomy**.

7. Bladder Cancer

- **Epidemiology & Risk Factors:**

    - **Smoking** is the most significant risk factor.
    - Occupational exposure (aromatic amines - rubber, dyes, paint).
    - More common in **males** and **older adults**.
    - Chronic inflammation (stones, long-term catheter, **Schistosomiasis**).
- **Histology:**
    - **Most common type (>90%) is Urothelial (Transitional Cell) Carcinoma (TCC).**
    - **Squamous Cell Carcinoma (SCC):** Associated with **chronic irritation/inflammation**, particularly **Schistosoma haematobium infection** (endemic areas like Egypt).
    - Adenocarcinoma: Rare, may arise from urachal remnant or glandular metaplasia.
- **Clinical Presentation:**
    - **Painless gross hematuria** is the classic symptom.
    - Irritative voiding symptoms (frequency, urgency, dysuria) - common with **Carcinoma in Situ (CIS)**.
- **Diagnosis:**
    - **Cystoscopy with biopsy** is essential for diagnosis and staging.
    - **Urine cytology**.
    - Upper tract imaging (CT Urogram) to rule out synchronous upper tract TCC.
    - **Bimanual examination** under anesthesia (during TURBT) assesses tumor mobility/fixation (information potentially not gained from imaging).
- **Staging (TNM):** Based on depth of invasion. Key distinction is Non-Muscle Invasive (NMIBC) vs. Muscle Invasive (MIBC).
    - CIS (Tis): Flat, high-grade lesion.
    - Ta: Non-invasive papillary tumor.
    - T1: Invades lamina propria.
    - **T2: Invades muscularis propria (muscle-invasive).**
    - T3: Invades perivesical fat.
    - T4: Invades adjacent organs/structures.
- **Treatment:**
    - **Non-Muscle Invasive (Ta, T1, Tis):**
        - **TURBT (Transurethral Resection of Bladder Tumor)** for diagnosis, staging, and treatment.
        - **Intravesical Therapy** following TURBT to reduce recurrence/progression:
            - Chemotherapy (Mitomycin C, Gemcitabine) for low/intermediate risk.
            - **BCG (Immunotherapy)** for **high-risk NMIBC (including CIS, high-grade T1)**.
        - Regular surveillance cystoscopy and cytology.
    - **Muscle-Invasive (≥T2):**
        - **Radical Cystectomy** (removal of bladder, prostate/seminal vesicles in men; bladder, uterus/ovaries/anterior vagina in women) with **pelvic lymph node dissection**. Requires **urinary diversion** (ileal conduit or neobladder).
        - Neoadjuvant chemotherapy (before cystectomy) often improves survival.
    - Metastatic Disease: Systemic chemotherapy.
    - Treatment for non-urothelial (SCC, Adeno): Primarily surgical (cystectomy).

8. Testicular Tumors

- **Epidemiology & Risk Factors:**
    - Most common solid malignancy in men aged **15-35**.
    - **Cryptorchidism** is a major risk factor.

- **Classification:**
  - **Germ Cell Tumors (GCTs) (95%):**
    - **Seminoma: Most common single histology type overall**. Usually age 30s-40s. Radiosensitive. Normal AFP. May have elevated β-hCG.
    - **Non-Seminoma Germ Cell Tumors (NSGCT):**
      - Embryonal Carcinoma: Aggressive. AFP and/or β-hCG often elevated.
      - **Yolk Sac Tumor (Endodermal Sinus Tumor): Most common testicular tumor in infants/children <3 years**. Produces **AFP**.
      - **Choriocarcinoma:** Highly aggressive, early hematogenous spread (especially lungs). Produces **β-hCG**.
      - Teratoma: Mature (benign potential in kids, may be malignant post-puberty) or Immature. Can have somatic malignant transformation. Usually normal markers.
      - Mixed GCT: Common (contain multiple types). Behavior/treatment based on most aggressive component.
  - Sex Cord-Stromal Tumors (Leydig, Sertoli): Less common.
  - Lymphoma: **Most common testicular mass in men >60**.
- **Clinical Presentation: Painless testicular mass** or enlargement.
- **Diagnosis:**
  - **Scrotal Ultrasound** is the primary imaging modality.
  - **Tumor Markers: AFP, β-hCG, LDH**. Checked before and after orchiectomy.
    - **AFP elevated:** Yolk sac, Embryonal, Mixed (NEVER pure Seminoma or Choriocarcinoma).
    - **β-hCG elevated:** Choriocarcinoma (always), Seminoma (sometimes), Embryonal, Mixed.
  - Staging CT scans (Chest/Abdomen/Pelvis).
  - **Needle biopsy is CONTRAINDICATED**.
  - Diagnosis and primary tumor staging based on **radical inguinal orchiectomy**.
- **Treatment:**
  - **Radical Inguinal Orchiectomy** is the first step for diagnosis and local control.
  - Further treatment depends on **histology and stage**:
    - **Seminoma:**
      - Stage I: Surveillance, adjuvant radiotherapy, or single-dose carboplatin chemotherapy.
      - Metastatic: Chemotherapy (platinum-based) or radiotherapy.
    - **Non-Seminoma:**
      - Stage I: Surveillance, adjuvant chemotherapy, or **Retroperitoneal Lymph Node Dissection (RPLND)**.
      - Metastatic: Chemotherapy +/- RPLND.
  - **RPLND:** Can be therapeutic and diagnostic. Nerve-sparing techniques aim to preserve ejaculatory function (sympathetic nerves).
- **Spread:** Primarily via **lymphatics** to **retroperitoneal (para-aortic)** nodes. **Choriocarcinoma** frequently spreads **hematogenously**.

9. Renal Tumors & Cysts

- **Renal Cell Carcinoma (RCC):**
  - Most common type of kidney cancer in adults. Adenocarcinoma arising from tubular epithelium.
  - **Risk Factors: Smoking**, obesity, hypertension, dialysis, genetic syndromes (**Von Hippel-Lindau (VHL)**).
  - **Histological Subtypes:**
    - **Clear Cell RCC (80%): Most common**. Often associated with VHL.
    - Papillary RCC (10-15%).

        - Chromophobe RCC (5%).
        - Collecting Duct RCC (rare, aggressive).
    - **Clinical Presentation:** Often found incidentally on imaging. Classic triad (hematuria, flank pain, palpable mass) is uncommon. Can present with paraneoplastic syndromes (polycythemia, hypercalcemia, HTN).
    - **Diagnosis: Contrast-enhanced CT** or MRI is best for evaluation of renal masses. Cannot reliably differentiate benign from malignant tumors based on imaging alone (except angiomyolipoma with fat).
    - **Treatment:**
        - Localized RCC: **Surgical removal** is mainstay.
            - **Partial Nephrectomy (Nephron-Sparing):** Preferred for smaller tumors (<4-7cm) when feasible, preserves renal function.
            - **Radical Nephrectomy:** For larger tumors or when partial is not feasible.
        - Metastatic RCC: Targeted therapy (VEGF inhibitors, mTOR inhibitors), immunotherapy. **RCC is generally resistant to traditional chemotherapy and radiotherapy.**
    - **Prognosis:** Stage is important. Presence of distant metastases (e.g., **pulmonary mets**) is a major negative prognostic factor.
- **Upper Tract Urothelial Carcinoma (UTUC):**
    - TCC arising in renal pelvis or ureter. Shares risk factors with bladder cancer (smoking).
    - Presentation: Hematuria, flank pain.
    - Diagnosis: CT Urogram, Ureteroscopy with biopsy.
    - Treatment: **Radical Nephroureterectomy** (removal of kidney, entire ureter, and cuff of bladder around ureteral orifice).
- **Renal Cysts:**
    - Very common, usually benign simple cysts.
    - **Bosniak Classification** (based on CT features) estimates malignancy risk and guides management:
        - Bosniak I/II: Simple/minimally complex, benign. No follow-up needed.
        - Bosniak IIF: Minimally complex, requires follow-up imaging. Low malignancy risk.
        - Bosniak III: Indeterminate, complex features (thick septa, enhancement). Moderate malignancy risk (~50%). Often require surgical excision (partial/radical nephrectomy).
        - **Bosniak IV:** Clearly malignant features (enhancing solid components). High malignancy risk (>90%). **Require surgical excision.**

10. Urinary Tract Infections (UTI)

- **Definitions:**
    - Cystitis: Infection of bladder.
    - Pyelonephritis: Infection of kidney parenchyma and renal pelvis.
    - Bacteriuria: Bacteria in urine.
    - Pyuria: White blood cells in urine.
    - **Asymptomatic Bacteriuria:** Bacteriuria without symptoms (usually colonization, not infection). Requires treatment only in specific situations (e.g., pregnancy, prior to urologic procedures).
- **Epidemiology & Pathogens:**
    - **Escherichia coli (E. coli)** is the **most common pathogen** overall, including in children.
    - Other common pathogens: Klebsiella, Proteus, Enterococcus, Staphylococcus saprophyticus.
    - **Proteus mirabilis:** Associated with **struvite stones** (urease producer).
    - **Nosocomial UTIs:** Often associated with **catheterization**, may involve more resistant organisms (Pseudomonas, Enterobacter).

- **Clinical Presentation:**
  - Cystitis: Dysuria, frequency, urgency, suprapubic pain, hematuria.
  - **Pyelonephritis: Fever, chills, flank pain (loin pain)**, nausea/vomiting, +/ - lower tract symptoms. **Dysuria can occur but may be less prominent than cystitis.** Can cause perinephric abscess.
- **Diagnosis:**
  - **Urine analysis:** Look for pyuria (leukocyte esterase), bacteriuria (nitrites - specific but not sensitive). Microscopy confirms WBCs, RBCs, bacteria.
  - **Urine culture:** Identifies organism and sensitivities. Significant bacteriuria usually defined as >10^5 colony-forming units (CFU)/mL (or 10 bacteria per high power field).
  - Imaging (Ultrasound, CT): Usually reserved for complicated UTI, suspected pyelonephritis, recurrent infections, or suspected obstruction/abscess/stone.
- **Management:**
  - Uncomplicated Cystitis: Short course oral antibiotics (e.g., Nitrofurantoin, TMP-SMX, Fosfomycin).
  - Pyelonephritis: Longer course of antibiotics (oral fluoroquinolones or TMP-SMX if susceptible; IV antibiotics like ceftriaxone, fluoroquinolones, aminoglycosides if severe/unable to tolerate oral). **Admission** may be needed for severe illness, dehydration, obstruction, comorbidities.
  - Complicated UTI (associated with obstruction, stone, catheter, pregnancy, male sex, diabetes, immunosuppression): Requires broader spectrum antibiotics, longer duration, investigation/management of underlying factor.
- **Xanthogranulomatous Pyelonephritis:** Rare, severe chronic inflammation leading to renal destruction, often associated with Proteus/E.coli and obstruction.
- **Urogenital Tuberculosis:** Can cause sterile pyuria, hematuria, urinary frequency/urgency. Requires specific anti-TB treatment. Diagnosis may involve urine AFB culture/PCR, imaging (IVU may show characteristic findings).

11. Male Infertility

- **Definition:** Failure to conceive after **1 year** of regular unprotected intercourse.
- **Causes:**
  - Pre-testicular: Hypothalamic/pituitary dysfunction (hypogonadotropic hypogonadism - low FSH/LH/Testosterone). Hyperprolactinemia.
  - Testicular: Primary testicular failure (e.g., Klinefelter syndrome, mumps orchitis, cryptorchidism, chemo/radiation). High FSH/LH, low Testosterone.
  - Post-testicular: Obstruction (e.g., congenital absence of vas deferens (CAVD), ejaculatory duct obstruction, vasectomy). Normal FSH/LH/Testosterone. **Azoospermia with normal FSH/LH suggests obstruction.**
  - **Varicocele: Most common surgically correctable cause**. Associated with impaired sperm parameters (Oligoasthenoteratospermia - OATs).
  - Idiopathic: Cause not identified in ~50%.
  - Other: Infection, medications, toxins, heat, genetic factors, **exogenous testosterone use** (suppresses pituitary FSH/LH).
- **Evaluation:**
  - History & Physical Exam.
  - **Semen Analysis (at least two):** Assess volume, concentration, motility, morphology.
  - **Endocrine Profile: FSH, LH, Testosterone**, Prolactin.
  - Scrotal Ultrasound: Assess testicular size, detect varicocele, masses.
- **Key Semen Findings:**
  - Azoospermia: No sperm in ejaculate.
  - Oligospermia: Low sperm count.
  - Asthenospermia: Poor motility.

- Teratospermia: Abnormal morphology.

- **Management:** Treat underlying cause (e.g., varicocele repair, hormonal therapy). Assisted Reproductive Technologies (IUI, IVF, ICSI). Sperm retrieval techniques (TESA, TESE) for azoospermia.
- **Semen Volume: Seminal vesicles** contribute the largest volume to ejaculate.

12. Kidney Transplant

- **Indications:** End-Stage Renal Disease (ESRD).
- **Donor Sources (Ranked by Graft Survival - Best to Worst):**
  1. Monozygotic twin
  2. HLA identical sibling
  3. Haplo-identical relative (parent, sibling, child)
  4. Living unrelated (spouse, friend)
  5. Deceased donor (Standard criteria > Expanded criteria)
- **Contraindications (Absolute Recipient):**
  - **Active malignancy**.
  - Active/chronic untreated infection.
  - Severe cardiovascular/pulmonary disease (prohibitive surgical risk).
  - Severe neuropsychiatric illness.
  - Active substance abuse.
  - **Life expectancy < 2-3 years**.
  - Non-compliance.
- **Rejection:**
  - **Hyperacute Rejection:** Occurs **minutes to hours** after transplant. Mediated by **pre-formed donor-specific antibodies** (e.g., from previous transplant, pregnancy, transfusion). Leads to thrombosis and irreversible graft loss. Prevented by pre-transplant crossmatching.
  - Acute Rejection: Occurs days to months later. Cell-mediated or antibody-mediated. Usually treatable with immunosuppression adjustment.
  - **Chronic Allograft Dysfunction/Rejection:** Occurs months to years later. Slow, progressive decline in graft function. Multifactorial causes including chronic immune injury, hypertension, drug toxicity (calcineurin inhibitors), recurrent disease, donor factors. Candida albican infection is **not** a cause of chronic rejection.

13. Pediatric Urology

- **Undescended Testis (Cryptorchidism):** (See Scrotal Pathologies). **Orchiopexy before 1 year (6-12 mo)**. Complications: infertility, malignancy, torsion, hernia.
- **Vesicoureteral Reflux (VUR):** Retrograde flow of urine from bladder to ureter/kidney.
  - Graded I-V based on severity.
  - Associated with **UTIs** and potential **renal scarring (cortical scarring)**.
  - Diagnosis: Voiding Cystourethrogram (VCUG). Renal ultrasound/DMSA scan assesses kidneys/scarring.
  - Management: Low grades often resolve spontaneously. Prophylactic antibiotics to prevent UTIs. **Surgical correction (ureteral reimplantation/subureteral injection)** indicated for: **breakthrough UTIs despite prophylaxis**, persistent high-grade reflux, new/progressive renal scarring, non-compliance with meds. Parental preference alone is **not** an indication.
- **Posterior Urethral Valves (PUV): Most common cause of congenital bladder outlet obstruction in males**. Obstructing membrane in posterior urethra. Presents with bilateral hydronephrosis (antenatal US), weak stream, UTI. Diagnosis: VCUG. Treatment: Valve ablation (endoscopic).
- **Nocturnal Enuresis:** Involuntary voiding during sleep in child >5 years old.

- Primary: Never achieved nighttime dryness. Secondary: Relapse after ≥6 months dry.
- Causes: Maturational delay, reduced bladder capacity, **decreased nocturnal ADH secretion**, sleep arousal difficulties, genetics, UTI, constipation.
- Treatment: Behavioral therapy (alarms), **Desmopressin (DDAVP)** - ADH analogue decreases urine output. Imipramine sometimes used.

- **Antenatal Hydronephrosis:** Dilation of renal pelvis +/- calyces detected on prenatal ultrasound. Needs postnatal evaluation (ultrasound, VCUG, renal scan) to determine cause (e.g., UPJ obstruction, VUR, PUV, multicystic dysplastic kidney).

14. Basic Physiology & Miscellaneous

- **Erection Physiology:**
  - Requires intact vascular, neurologic, hormonal systems.
  - **Parasympathetic stimulation** (S2-S4 via pelvic nerves) initiates erection: **Nitric Oxide (NO)** release → activates guanylate cyclase → increases cGMP → smooth muscle relaxation → increased arterial inflow & venous occlusion.
  - **Sympathetic system** mediates detumescence and **ejaculation**.
  - **Ischio-cavernosus muscles** contract during rigid erection phase.
- **Erectile Dysfunction (ED):**
  - Causes: Vascular (atherosclerosis, DM), Neurologic (spinal cord injury, MS, surgery), Hormonal (hypogonadism), Medications, Psychological.
  - **Psychogenic ED:** Often **sudden onset**, situational, **normal nocturnal/morning erections**, relationship issues.
  - **Organic ED:** Often **gradual onset**, consistent, **absent nocturnal/morning erections**.
- **Priapism:** Persistent erection (>4 hours) unrelated to sexual stimulation. **Urologic emergency**.
  - Ischemic (low-flow): Most common. Painful. Compartment syndrome of penis → tissue damage. Requires urgent detumescence (aspiration, injection of alpha-agonist like phenylephrine). Corpus cavernosum affected, **spongiosum and glans usually not**. Associated with sickle cell disease, medications (intracavernosal injections, trazodone).
  - Non-ischemic (high-flow): Less common. Usually painless. Often due to trauma creating AV fistula. Not an immediate emergency.
- **Anatomy Review:**
  - **Ureter Narrowest Points:** 1) Ureteropelvic junction (UPJ), 2) Pelvic brim (crossing iliac vessels), 3) **Ureterovesical junction (UVJ)** - **Narrowest**.
  - **Kidney Weight:** Approx 150g (Range provided: 81-160g).
  - **Renal Embryology:** Kidney develops from **intermediate mesoderm**. Metanephros forms permanent kidney.
  - **Vas Deferens / Epididymis:** Derived from **Wolffian (Mesonephric) duct**.
  - **Cremasteric Muscle:** Innervated by **genital branch of genitofemoral nerve**.
- **Hemospermia:** Blood in ejaculate. Usually benign, due to non-specific inflammation (prostate/seminal vesicles). Persistent cases require evaluation.
- **Bladder Diverticulum:** Outpouching of bladder wall. Can be congenital or acquired (due to chronic obstruction, e.g., BPH). Symptoms can include retention, UTI, discomfort.
- **Urinary Catheter Sizing: French (Fr) scale**. **Fr = Diameter (mm) x 3**.
- **Acute Tubular Necrosis (ATN):** Diuretic phase can cause electrolyte disturbances (**Hypokalemia**, Hypomagnesemia). Hyperkalemia is more typical of the oliguric phase/renal failure itself.