RFs

- Both: obstruction 2/2 nephrolithiasis, strictures, autonomic neuropathy, immusuppression 2/2 DM, delayed postcoital micturition, vesicoureteral reflux (all children <5yo should have voiding cytourethrogram (VCUG) to uncover reflux, Grading: I (up to nondilated ureter) II (up to nondilated pelvis) II (dilated ureter w/ blunting of papilla) IV (grossly dilated ureter) V (very grossly dilated ureter and loss of papillary impression), Low Grade Tx; prophylactic antibiotics High Grade Tx; surgical therapy)
- M: lack of circumcision (10x higher risk), insertive anal intercourse, obstruction 2/2 prostate pathology
- F: short urethra, wiping "back to front", use of diaphragm w/ spermicide which alters flora, obstruction 2/2 pregnancy or ob/gyn path, Lewis blood group "non-secretor", P1 blood group phenotype, estrogen deficiency
- Nosocomial Catheters
    - 10% risk Qd therefore ~100% of pts will get a UTI if >10d (RFs: (1) inoculation during insertion, (2) serves as a conduit for entrance, (3) glycolax that forms on the surface protects bacteria, (4) catheter destroys GAG layer of bladder and blunts WBC response, (5) catheter do not completely drain bladder therefore there is a residual volume greater than in normal bladders and it acts a reservior for bacterial growth
    - 1) internal indwelling catheters: one way catheter or two way Foley that are left in for several days
    - 2) internal intermittent catheters: catheters that are used and the removed immediately
    - 3) external catheters: condom like structure is placed over penis
    - 4) suprapubic catheter: catheter placed directly thru skin into bladder

Mechanism

- Prostatitis/Urethritis (LUTI) Ascending Infection (95%) w/ Enteric Bugs (Healthy Pt) *E.coli* 70%, *S.saprophyticus* 20%, *Klebsiella* spp., *Enterococcus fecalis* vs Enteric + Non-EntericBugs (Hospitalized Pt) *Proteus mirabilis/vulgaris*, *Psuedomonas* spp., *Serratia* spp., *Providencia rettgeri* → Cystitis (LUTI) → Ureteritis (UUTI) → Pyelonephritis (UUTI) → Complications (Renal Papillary Necrosis, Intrarenal / Parenephric Abscess, Xanthogranulomatous Pyelonephritis (Proteus, granuloma w/ lipid laden MΦ), Emphysematous Pyelonephritis (Psuedomonas, DM)
    - Can also acquire via bacteremia w/ S.aureas, Fungi, TB, etc, and if you culture these pathogens in urine you must check blood
    - only >100,000 CFU/mL is considered UTI anything below is NOT
    - all UTI bacteria have pili/fimbriae which is necessary for them to move against urine flow and attach to wall
    - Tamm-Horsefall proteins produced by tubule cells bind mannose-epitopes on bacteria that have Type-1 fimbriae
    - Nephronia: a focal infection in the kidney
- **Interstitial Cystitis (IC)**
    - Def: LUT S/S but w/o an identifiable etiology including UTI, overactive bladder, nephrolithiasis, etc
    - Theories: occult infection, altered pain sensation, GAG deficient urothelium such that toxins can enter mucosa more easily and cause inflammation, mast cell activation near sensory nerve terminals in urothelium, etc
    - Dx: DOE and thus negative general/pelvic PEx, negative UA/UTI (there is no evidence of inflammation), negative cystoscopy
        - NB based on the GAG deficient theory urologists perform a Potassium Sensitivity Test (PST) in which potassium is instilled into bladder and if urothelium is leaky potassium will cross and activate nerves and cause pain
        - NB presence of biomarkers in urine like Anti-Proliferative Factor (APF), InterLeukin-6 (IL-6), GlyoProtein-51 (GP-51), etc
    - Tx:
        - Effective: nothing just counseling
        - ? Effectiveness: NSAIDs, hydrodistention (stretch bladder with saline), abx which eliminates an potential occult infection, amitryptiline (Elavil) and gabapentin (Neurontin) which alters pain sensation, oral sodium pentosan polysulfate (Elmiron) and intravesical instillation of dimethyl sulfoxide (Rimso-50) which reverses the urothelium GAG deficiency, hydroxyzine (Atarax) which reverses mast cell activation, cyclosporine A, steroids, heparin, intravesical installation of anesthetics, etc
        - NO Effectiveness: anticholinergics, antispamodics

NB typically in children the only symptoms are fever, failure to thrive, vague GI complaints, enuresis	**LUTI** (Lower Urinary Tract Infection)	**UUTI** (Upper Urinary Tract Infection)
Local Symptoms	dysuria, frequency, urgency, suprapubic pain	NONE
General UTI Symptoms	hematuria, pyuria, bacteruria	
Constitutional Symptoms	NONE	flank pain /CVAT, F, N/V, chills, HA, malaise, night sweats, weakness, anorexia, very ill looking, leukocytosis, elevated ESR

Uncomplicated LUTI	**Complicated LUTI**	**Uncomplicated UUTI**	**Complicated UUTI**
	• refractory to other treatments • pregnancy		• old • very ill

	• pt scheduled to undergo urologic surgery • 0-2yrs (10-14d) 2yrs-18yrs (5-7d) • adult males • spread beyond bladder • structural abnormalities • functional abnormalities • metabolic disorders • pregnant (don't use FQ b/c teratogenic rather use Bactrim, Amoxicillin, NF) • obstruction • indwelling catheter **(only Tx if symptomatic b/c pts are often colonized)** • renal impairment • renal transplant • immunosuppression		• urosepsis • unable to tolerate po meds • emphysematous pyelonephritis (by gas producing bacteria, usually in DM)
Asymp: no Tx Symp: Bactrim x3d but some areas have resistance up to 15% therefore some check cultures to determine if pt needs FQ x3d however most just start bactrim and if pt's Sx do not resolve or there is continued bacteriuria then abx is switched to a FQ because likely resistant to bactrim therefore cultures are rarely done, FQ resistance is also starting to emerge, also one can do nitrofurantoin x7d	FQ x7-14d (NB cipro, gati, or levo NOT moxi or gemi b/c low concentration in bladder)	Outpt: 1° FQ x7d 2° Augmentin x14d or Ceph x14d or Bactrim x14d	Inpt: 1° FQ x14d iv until afebrile for 1-2d then po for 2wks
Dysuria • Phenazopyridine (Pyridium) 200mg 1tab po TID after meals, SEs: orange discoloration of fluids, Contraindications: hepatitis, RF, NB there are OTC versions like "Azo", "Urogesic", et al • Methylene Blue (Methylene Blue) 65-130mg 1tab po TID after meals w/ water, SEs: blue-green discoloration of fluids, Contraindications: none			
Recurrent • w/in 2ks of Tx cessation (cont prior Tx for two more weeks) • ≥3 UTIs/yr (Bactrim-DS x1d after intercourse, Bactrim-SS daily, or pt initiated Bactrim-DS x3d when symptoms arise) • Always inquire about RFs • Advice pt about cranberry juice/pills for prophylaxis		Recurrent • w/in same day (cont prior Tx for 6wks) • new (new Tx for 2wks)	