Urinary tract infection (UTI)

introduction	• anatomically, divided into upper & lower UTI • patient presents with urinary symptoms and significant bacteriuria 10^5 (= 100,000) CFU/ml • significant bacteriuria + no symptoms → asymptomatic bacteriuria	
prevalence	↑ with age, more in females (especially during childbearing years → 17 - 45)	
classification	Lower UTIs	• Cystitis (infection of the bladder, superficial mucosal infections) • Urethritis (**sexually** transmitted pathogens) • Prostatitis and epididymitis
	Upper UTIs	• Acute pyelonephritis or chronic pyelonephritis
	Uncomplicated UTI	• healthy non-pregnant young sexual active female
	Complicated UTI	• nosocomial UTIs • relapses • structural or functional abnormalities • urologic dysfunction UTI of men

different microorganisms that can cause UTI (from the practical)

gram +ve cocci	Enterococcus		anaerobic / colon normal flora
	Streptococcus agalactiae (group B)		-ve catalase colon normal flora / **pregnant women** & neonates & diabetic patients
	Staphylococcus saprophyticus		+ve catalase / -ve coagulase / novobiocin-resistant normal flora of the female genital tract & perineum **females in childbearing years** (the risk ↑ with sexual activity → honeymoon cystitis)
	Staphylococcus aureus		+ve catalase / +ve coagulase [usually with systemic manifestation (bacteremia)]
gram -ve bacilli	+ LF	Escherichia coli	-ve urease & -ve citrate / +v indol test **most common** / colon normal flora
		Klebsiella	+ve urease & +ve citrate mucoid colonies in CLED agar
	- LF	Proteus	-ve oxidase / +ve urease swarming growth in blood agar / **stones formation particularly in children**
		Pseudomonas aeruginosa	+ve oxidase **nosocomial** (hospital-acquired infection) / blue-green colonies in nutrient agar
others	Candida albicans		in immunocompromised patients / catheterization
	Schistosoma haematobium		parasite / in endemic area
	Tricomonas vaginalis		causes vaginitis

* LF = lactose fermenter

cystitis

risk factors *	in women	• Genetic factors • Short wide urethra + sexual intercourse • Pregnancy (progesterone, obstruction) • Decreased estrogen production during menopause
	in men	• persistent bacterial infection of the prostate.
	in both sexes	• Presence of bladder stone • Sexual transmitted disease (gonorrhea, herpes, chlamydia) • Urethral stricture • Catheterization of the urinary tract • Diabetes mellitus
pathogenesis	1. The infection results when the bacteria ascends from the urethra to the urinary bladder,causing frequent irritations of their mucosal surfaces 2. These bacteria are either resident or transient members of the perineal flora that are derived from the large intestine flora nearby. 3. Toxins then get produced. • Condition that create access to bladder: Sexual intercourse due to short urethral distance.	
etiologic agents	infectious cystitis	non infectious cystitis
	• **gram -ve:** **E.coli** is the most common (90%). Klebsiella pneumoniae, Proteus spp, P.aeruginosa. • **Gram +ve:** Enterococcus faecalis, group B Streptococcus Staphylococcus saprophyticus (honeymoon cystitis) • **Candida species (rare)** • **venereal diseases** (gonorrhea, Chlamydia) may present with cystitis • **Schistosoma hematobium** in endemic area (eosinophilic cystitis)	• **traumatic cystitis** in women • **interstitial cystitis** unknown cause, may be due to autoimmune attack of the bladder • **hemorrhagic cystitis** due to radiotherapy or chemotherapy
Pathogens involved	Uncomplicated UTIs	**E. coli (64%) Enterobacteriaceae (16%), Enterococcus spp (20%)** S. epidermidis, S. saprophyticus, Yeasts Viruses (adeno, varicella), Chlamydia trachomatis
	Complicated UTIs	**E. coli, Enterobacteriaceae, Pseudomonas spp, Acinetobacter spp**
clinical presentation *	Symptoms usually of acute onset: • Dysuria (painful urination or micturition) • Frequency (frequent voiding) • Urgency (an imperative call for toilet) • Hematuria in 50% of cases. • Usually no fever (localized)	

Laboratory diagnosis of cystitis	Specimen collection	• Most important is clean catch urine [Midstream urine (MSU)] to bypass contamination by perineal flora and must be before starting antibiotic. • Supra-pubic aspiration or catheterization may be used in children. • Catheter urine should not be used for diagnosis of UTI.
	Microscopic examination	• About 90% of patients have > 10 WBCs /mm^3 (pyuria) • Gram stain of uncentrifuged sample is sensitive and specific (rarely done) • One organism per oil-immersion field is indicative of infection. • Blood cells, parasites or crystals, casts can be seen

	Chemical screening tests (Not specific)	• Urine dipstick rapidly detects:
		  ○ nitrites released by bacterial metabolism.
		  ○ leukocyte esterase from inflammatory cells.
		• negative results doesn't mean there is no cystitis

	Urine culture	• important to:
		  ○ identify bacterial cause
		  ○ identify antimicrobial sensitivity.
		• **Quantitative culture** typical of UTI (>10^5 /mm^3).
		• Lower count (10^4 for example) is indicative of cystitis if the patient is symptomatic.
		• NOTE: the specimen should be taken in the right way [MSU] (to bypass contamination). and the specimen shouldn't stay more than 2 hours without processing because during this time the microorganism will proliferate and ↑ in number → false positive result

recurrent cystitis	• 3 or more episodes of cystitis /year • Requires further investigations such as Intravenous Urogram (**IVU**) or ultrasound to detect obstruction or congenital deformity. • Cystoscopy is required in some cases	
management	treatment	• Empiric treatment commonly used depending on the knowledge common organism and sensitivity pattern. • Treatment best guided by susceptibility of the causative bacteria. • Common agents: Ampicillin, Cephradine, Ciprofloxacin, Norfloxacin, Gentamicin ,TRM-SMX or nitrofurantoin (study pharma)
	duration	• 3 days for uncomplicated cystitis • 10-14 days for (complicated & recurrent cystitis) + upper UTI
	prophylaxis	• for recurrent cases required by Nitrofurantoin or TRM-SMX
	prevention	• drinking plenty of water and prophylactic antibiotic

Dysuria + frequency are seen in cystitis (80% of cases) but they are also associated with other things:	
vaginitis (5%)	Candida spp. - Tricomonas vaginalis
Urethritis (10-15%)	Chlamydia trachomatis - Neisseria gonorrhoeae - Herpes simplex
Non infectious (<1%)	Hypoestrogenism - Functional obstruction - Mechanical obstruction - Chemicals

cystitis vs urethritis

- Cystitis:
  - more acute onset
  - more sever symptoms
  - Pain, tenderness on the supra-pubic area
  - Presence of Bacteria in urine (bacteriuria)
  - Urine cloudy, malodorous and may be bloody