

Urinary Tract Infections (UTI)

Pathophysiology	<ul style="list-style-type: none"> Urinary Tract: Anatomic unit united by a continuous column of urine from urethra to kidneys Infection usually established by bacteria entering bladder via urethra perianal & perineal areas (Bacteria from patient's own bowel flora proliferate in bladder (community acquired)) 	
	Common Pathogens	<ul style="list-style-type: none"> Escherichia coli (70%) Enterococcus faecalis (10%) Klebsiella (10%) Others including Proteus, Staphylococcus, Pseudomonas (10%)
Host Defence	<ul style="list-style-type: none"> Nonimmune mechanism: <ul style="list-style-type: none"> Antibacterial activity of urine due to extreme osmolality, high urea concentration, low pH Flushing mechanism (shearing force of micturition & urine flow) Innate immunity (critical factor): Complex process involving recognition & response to adherent microbes by uroepithelial cells, & proinflammatory response involving cytokines & inflammatory cells Adaptive immunity (T Cell, B Cells): Less important than innate immunity Genetic susceptibility (Minimally recognised) 	
Differences between Men & Women UT	Females:	<ul style="list-style-type: none"> Moister periurethral space Shorter distance between anus & urethral opening Shorter distance between urethral opening & bladder ↑Exposure to potential uropathogens = Enhances pathogens' ability to colonise urinary tract
Severity of UTI (from 1 [low] to 5 [high])	1) Asymptomatic bacteriuria 2) Cystitis (Uncomplicated UTI) 3) Cystitis (Complicated UTI)	4) Pyelonephritis 5) Sepsis (Urosepsis)
Risk Factors for UTI	<ul style="list-style-type: none"> Females (much more than men) <ul style="list-style-type: none"> 10-20% of F will have ≥ 1 UTI in lifetime ↑Sexual activity = ↑Risk of recurrent UTIs (Can be mitigated by emptying bladder after sex) Shorter urethral to anus length Intercourse Diaphragm/spermicide (dmg to epithelial lining = ↑Bacteria Adhesion) Delayed post-coital micturition Urinary retention: Drug induced (Anticholinergics) Urinary Catheter (Foreign body, where bacteria can grow) Renal stones Prostatic hyperplasia (BPH) Obesity Dementia/Parkinson's Disease Pregnancy <ul style="list-style-type: none"> Similar UTI incidence between pregnant vs non-pregnant BUT if untreated pregnancy, pyelonephritis develops in 23-40% Diabetes (2-3X ↑Risk; Good HbA1c control lowers risk) Hospital nosocomial UTIs (30-45%, with 80% related to catheters) Medication (e.g. empagliflozin (SGLT2I)) 	

Signs & S_x	UTI	<ul style="list-style-type: none"> • Cystitis (inflammation of bladder) • Dysuria, frequency, urgency, bacteriuria • Positive urine dipstick test • Often no fever
	Pyelonephritis	<ul style="list-style-type: none"> • Flank pain • Tenderness • N&V • Fever
	(Uro)sepsis	<ul style="list-style-type: none"> • Septic signs such as low BP, fast heart rate, rapid breathing, confusion
UTI Recurrence	<ul style="list-style-type: none"> • Single/isolated attack (90%) • Recurrent attacks (10%) <ul style="list-style-type: none"> ○ Reinfection (80% of 10%): Recurrence of bacteriuria with usually same micro-organism (but can be different), which can occur anytime, but frequently >14 days (wks to mths later) ○ Relapse (20% of 10%): Due to same micro-organism present prior to Tx & usually recurs within 1-2 wks after completion of Tx due to bug persistence (e.g. anatomical problem within urinary tract) 	
Uncomplicated vs Complicated UTI	Uncomplicated	<ul style="list-style-type: none"> • Non-pregnant otherwise health immunocompetent female with community acquired UTI who has no structural abnormalities of UT & who has not had frequent or failed courses of antibiotics & no catheter • Functionally normal UT: Mainly in non-pregnant women & due to E coli (70-95%) • May be asymptomatic • No associated disease • Recurrent infection/kidney dmg are rare
		T_x
	Complicated	<ul style="list-style-type: none"> • Not Uncomplicated UTI • With normal UT: Associated with disease/comorbidity (e.g. diabetes mellitus) • With abnormal UT: Kidney Stones, obstructions (large prostate), Polycystic kidneys, reflux, Bladder is not working properly (e.g. after stroke) • Both have risk of treatment failure, kidney damage & septicaemia
Sepsis & UTI	<ul style="list-style-type: none"> • Complicated UTI/Pyelonephritis left untreated can cause sepsis • Infection enters blood stream & travels upstream = Organ Dmg & Death 	
UTI Diagnosis	<ul style="list-style-type: none"> • Urine examination: cloudy, turbidity • Clinical signs & symptoms of patient: Dysuria <ul style="list-style-type: none"> ○ Back pain & tenderness, fever, chills (sign of pyelonephritis) ○ ↑Frequency of micturition • Urine collected by mid-stream void • Urine strip (dipstick) test 	

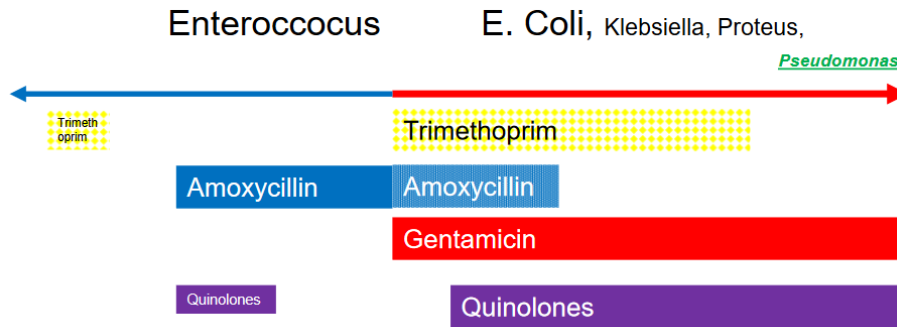
	<ul style="list-style-type: none"> ○ Good to exclude a UTI ○ Lots of false positives ○ Leukocytes/nitrites/protein indicate UTI ○ Nitrite Sensitivity: 85-92%, Specificity: 39-53% ● Microscopy (Identification of Gram+ cocci or Gram– rods) <ul style="list-style-type: none"> ○ Colony count $\geq 10^5$/mL ○ Haematuria: >5 RBCs per High Power Field ○ Pyuria: >15 WBCs per HPF ● Culture 		
Antibiotic Selection	<ol style="list-style-type: none"> 1) Confirmation of infection (Urine dipstick, MSU (turbidity), Signs & S_x) 2) Identification of pathogen (MSU/Culture) 3) Selection of therapy <ul style="list-style-type: none"> ○ Eradication: Goal is sterilisation of UT ○ Prophylaxis (Suppression) 4) Monitoring & assessment of response 		
When is MSU needed?	<ul style="list-style-type: none"> ● Over versus under-diagnosis (Only half of treated UTIs in Nursing homes that are treated should have be treated but Under-treatment of real UTIs may increase BSI/mortality) ● Obtain urine samples for cultures before antibiotic therapy <ul style="list-style-type: none"> ○ Pregnant women ○ Men ○ Aged-care facility residents ○ Patients who have recently taken antibiotics/have failed treatment ○ Patients who have recurrent infection ○ Patients who have travelled internationally within past 6 mths ○ Generally sick patients 		
T_x	Asymptomatic Bacteriuria	<ul style="list-style-type: none"> ● < 10⁵ cfu/mL (midstream) ● Common in elderly (5-50% in >80yrs), Women (transient, post-sexual activity) & if Bladder that is not working properly (e.g. Stroke) ● If Untreated: No morbidity/mortality ((Exception: Pregnancy) 	
		T_x	<ul style="list-style-type: none"> ● Controversial ● Yes: Pregnancy (↓Risk of pyelonephritis by 75%) ● Yes: High risk paediatric patients, prior to invasive urological procedures ● No: Bladder is not working properly or in elderly
	Acute Uncomplicated Cystitis	<ul style="list-style-type: none"> ● Often empiric & patient initiated ● Short course oral antibiotics (3-5 days) 	
		Women	<ul style="list-style-type: none"> ● Trimethoprim 300mg at night for 3 days ● Nitrofurantoin 100mg 6-hrly for 5 days ● Cephalexin 500mg 12-hrly for 5 days ● Amoxicillin/Clavulanic acid 500/125mg 12-hrly for 5 days ● If proven resistance for above Drugs: Norfloxacin 400mg q12h for 3 days

		Pregnant	<ul style="list-style-type: none"> • Nitrofurantoin 100mg 6-hrly for 5 days • Cephalexin 500mg 12-hrly for 5 days • Amoxicillin/Clavulanic acid 500/125mg 12-hrly for 5 days • <u>BEST NOT TO USE Trimethoprim</u>
		Men	<ul style="list-style-type: none"> • In 90% of UTIs, there is also prostatitis/epididymitis • Trimethoprim 300mg at night for 7 days • Nitrofurantoin 100mg 6-hrly for 7 days • Cephalexin 500mg 12-hrly for 7 days • Amoxicillin/Clavulanic acid 500/125mg 12-hrly for 7 days • If proven resistance for above Drugs: Norfloxacin 400mg q12h for 7 days (Longer duration of therapy is required if prostatitis is suspected)
		More about Trimethoprim	<ul style="list-style-type: none"> • Give at night to maximise urinary conc. for UTI • If Renal Impairment: <ul style="list-style-type: none"> ○ Monitor serum K⁺ (Start day 3) ○ Can cause hyperkalaemia (1-2 per 1000 patients treated) ○ May falsely elevate creatinine (prevents creatinine secretion in distal tubes) • Single-dose T_x for uncomplicated lower UTI in women may be considered (T_x for 3 days is more effective in preventing relapse)
	Pyelonephritis	<ul style="list-style-type: none"> • Culture & sensitivity important Whilst awaiting results of investigations: • Amoxicillin + Clavulanate 875+125 mg orally, 12-hourly for 14 days. If clinical response is rapid, stop therapy after 10 days. If pathogen is susceptible to any of following narrower-spectrum antibiotics, stop empirical regimen & switch to: • Amoxicillin 500 mg orally, 8-hourly for 14 days. If clinical response is rapid, stop therapy after 10 days OR • Trimethoprim 300 mg orally, daily for 14 days. If clinical response is rapid, stop therapy after 10 days OR • Cefalexin 500 mg orally, 6-hourly for 14 days. If clinical response is rapid, stop therapy after 10 days If resistance to all above drugs is confirmed/pathogen is Pseudomonas aeruginosa, use: • Ciprofloxacin 500 mg orally, 12-hourly for 7 days. 	

		<p>If severe:</p> <ul style="list-style-type: none"> • IV Gentamicin + [IV Amoxicillin/Ampicillin 2g 6-hrly] • If gentamicin is contraindicated: 3rd gen cephalosporin: Ceftriaxone 1g od/Cefotaxime 1g 8-hourly
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Gram positive

Gram negative



Urinary Catheter

Indwelling Catheter	<ul style="list-style-type: none"> • 20% patients have a urinary catheter placed during hospital admission • Account for ~30% of nosocomial infections • Bacteriuria & pyuria are common (Risk of bacteriuria 3-10% per catheter day) • Urine cultures & treatment (Treat if symptomatic. Don't treat if asymptomatic) • Bacteria colonising catheter biofilm may not necessarily be present in bladder (Collect sample through new catheter/remove & collect mid-stream urine) • If treating, need to change catheter • Obtain urine samples before starting antimicrobial therapy • Evidence to support routine use of prophylactic antibiotics at time of catheter placement insertion not strong
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