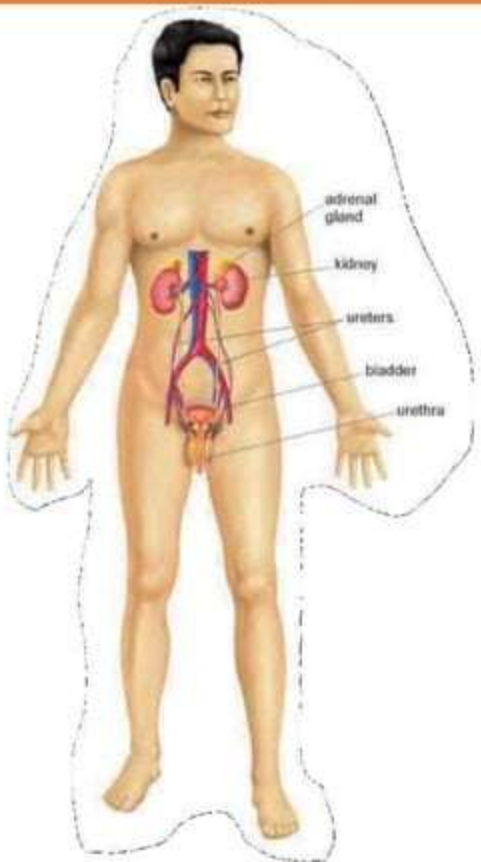
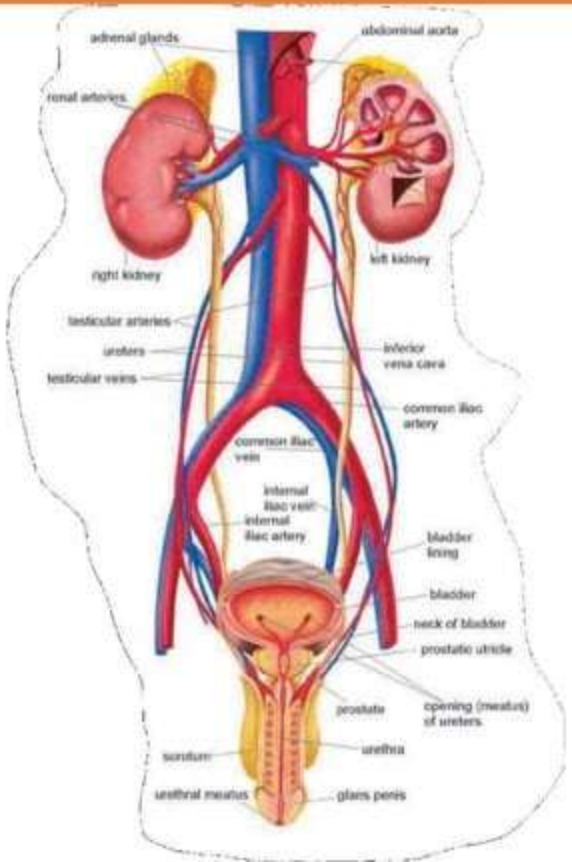
URINARY TRACT INFECTIONS

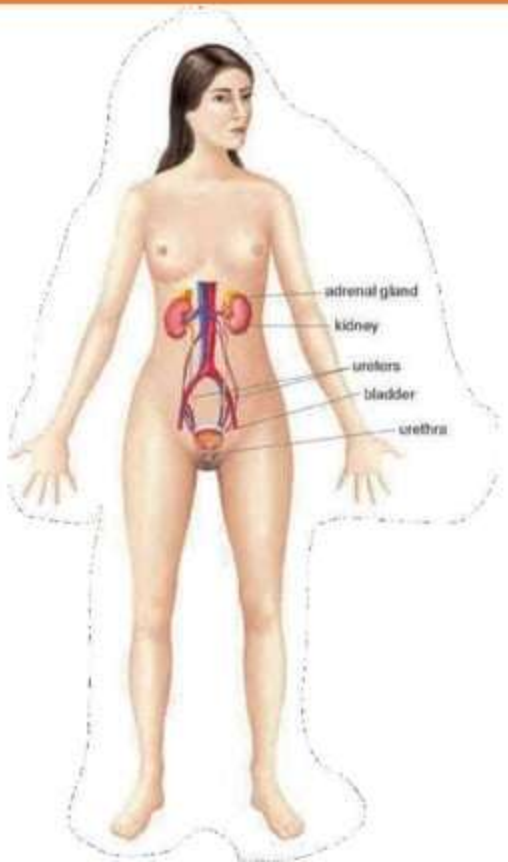
C. Ushasree
Dept. of pharmacology

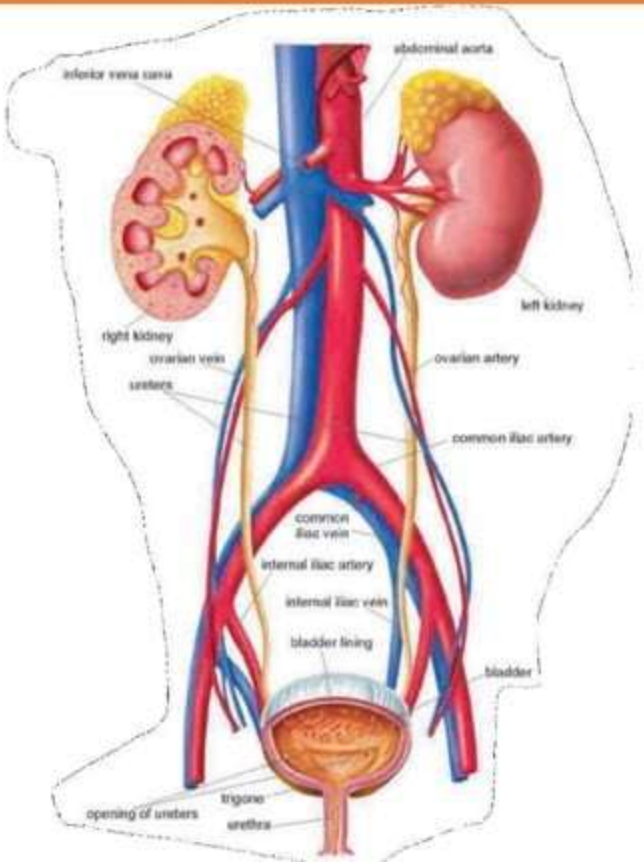
URINARY TRACT ANATOMY





URINARY TRACT ANATOMY





INTRODUCTION

- Urinary tract infection (UTI) is an **infection in any part of urinary system** – kidneys, ureters, bladder and urethra
- UTI is **common**, particularly in **women**, most often occurring in a normal urinary tract and usually as cystitis; half of all women will experience a UTI in their lifetime
- They can occur in either an **uncomplicated host setting**, where there is no underlying structural or functional abnormality of the patient's genitourinary tract, or complicated, where there is
- It is **uncommon** in men and children; when diagnosed, it often occurs in an abnormal urinary tract

- UTI is **not always uncomplicated**; recurrent infection causes life considerable morbidity and infection can lead to threatening Gram negative septicemia and kidney failure
- It can be:
  act infection – **urethritis** & **cystitis**
  i. Upper tract infection – acute **pyelonephritis**
- Growth of **$>10^5$ organisms/ml** from mid-stream clean catch urine samples is diagnostic of UTI
- In symptomatic patients, small number of bacteria may also be diagnosed as UTI

PATHOPHYSIOLOGY

BACTERIA

- Specific means bacteria causing granulomas with specific histopathology:
  i. TB Bacilli
  ii. Syphilis
  iii. Fungal infection

- Non – specific:
  i. E – Coli (80%)
  ii. Klebsiella
  iii. Proteus
  iv. Enterobacter sp.

PATHOPHYSIOLOGY

PARASITIC

- Bilharziasis
- Echinococcus granulosus (Hydatid cyst)

PROTOZOAL

- Trichomonas vaginalis

HELMINITHIC

- Pin worms or Enterobius

PATHOPHYSIOLOGY

UNCOMPLICATED UTI

Uncomplicated UTI is usually considered to be cystitis or pyelonephritis that occurs in premenopausal adult women with:

i. No structural or functional abnormality of urinary tract
ii. Not pregnant
iii. Have no significant comorbidity that could lead to more serious outcomes

COMPLICATED UTI

Can involve either sex at any age. UTI is considered complicated if:

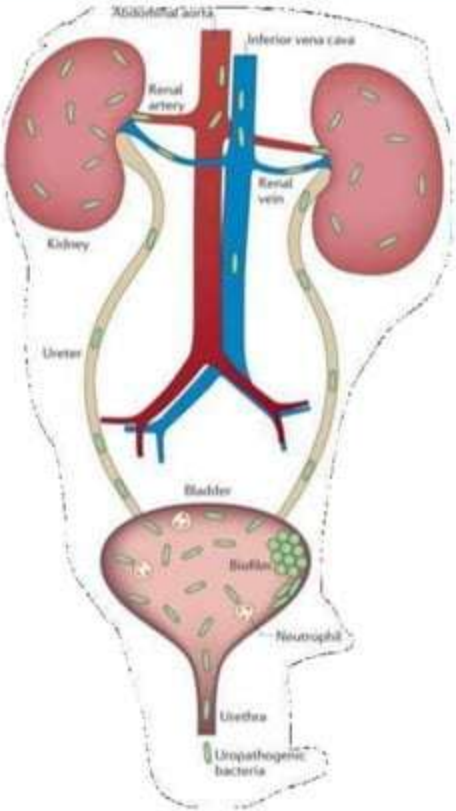
i. The patient is a child, is pregnant,
ii. Patient has any of the following:
    - A structural or functional urinary abnormality and obstruction of urine flow
    - A comorbidity that increases the risk of acquiring infection or resistance to treatment such as poorly controlled diabetes, chronic kidney disease or immunocompromise
    - Recent instrumentation or surgery of urinary tract

PATHOPHYSIOLOGY

ROUTE OF INFECTION

- Ascending
- Iatrogenic
- Hematogenous
- Lymphogenous
- Extension from neighboring organs
- From a focus in the kidney or prostate

PATHOPHYSIOLOGY



Ascension to the kidneys

Epithelial damage by bacterial toxins & protease

Biofilm formation

Bacterial multiplication & immune system subversion

Neutrophil infiltration

Colonization & invasion of bladder, mediated by pili & adhesins

Inflammatory response in the bladder & fibrinogen accumulation in the catheter

Colonization of the urethra & migration to the bladder

Contamination of the periureteral area with a uropathogen from the gut

INNATE HOST DEFENSE

Innate host defense prevents UTIs in the following ways:

URINE

- Acidic pH: intolerable by pathogens
- High urine osmolality
- Urinary inhibitors of bacterial adherence
- Competitive inhibitors of attachment to uroepithelial cells
- Mechanical flushing of urine flow

MUCOSAL IMMUNITY

- Urothelial secretion of cytokines and chemokines
- Mucopolysaccharides increases difficulty penetration lining: of bacteria l
- Mucosal IgA
- In men: prostatic secretions contain bactericidal zinc and urethra is longer

RISK FACTORS

Factors resulting in compromise of normal host defenses to bacterial
colonization are an important step in pathogenesis of UTIs

IATROGENIC / DRUGS

- Indwelling catheter
- Antibiotic use
- Spermicides

BEHAVIOURAL

- Voiding dysfunction
- Frequent or recent sexual intercourse

ANATOMIC / PHYSIOLOGIC

- Vesicoureteral reflux
- Female sex
- pregnancy

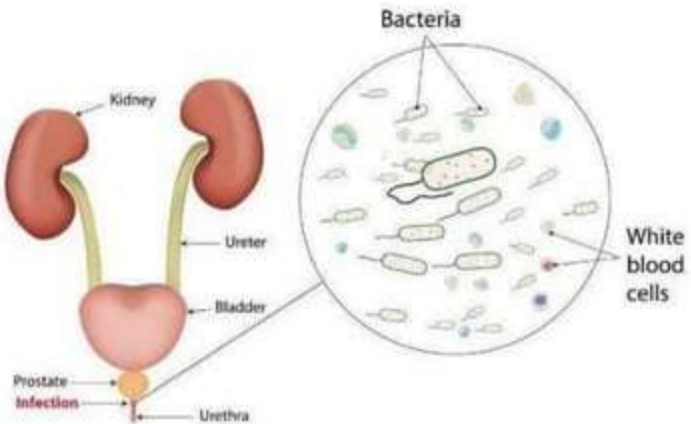
GENETIC

- Familial tendency
- Susceptible uroepithelial cells
- Vaginal mucus properties

CLASSIFICATION

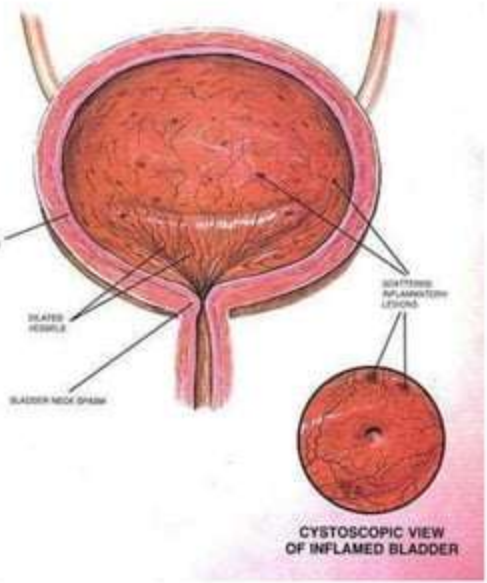
URETHRITIS

- Infection of the urethra with bacteria occurs when organisms that gain access to it acutely or chronically colonize the numerous **periurethral glands** in the bulbous and pendulous portions of the male urethra and in the entire female urethra.
- The **sexually** transmitted pathogens *Chlamydia trachomatis*, *Neisseria gonorrhoeae* and *herpes simplex virus* are common causes in both sexes



CLASSIFICATION

- Infection of the bladder :It is common in women, in whom cases of uncomplicated cystitis are usually preceded by sexual intercourse (honeymoon cystitis)
- In men, bacterial infection of the bladder is usually complicated and usually from ascending infection from the urethra or prostate or is secondary to urethral instrumentation
- The most common cause of recurrent cystitis in men is chronic bacterial prostatitis.



CLASSIFICATION

ACUTE URETHRAL SYNDROME

- Occurs in women, is a syndrome involving **dysuria**, **frequency**
  and **pyuria**, which thus resembles cystitis
- However, in acute urethral syndrome (unlike in cystitis), routine urine cultures are either **negative** or show colony counts that **lower** than the traditional criteria for diagnosis of bacterial cystitis
- Urethritis is a possible cause because causative agents include *Chlamydia trachomatis* and *Ureaplasma urealyticum*, which are not detected on routine urine culture

CLASSIFICATION

ASYMPTOMATIC BACTERIURIA

- Absence of UTI signs or symptoms in a patient whose urine culture satisfies criteria for UTI
- Pyuria may or may not be present
- Because it is **asymptomatic**, such bacteriuria is found mainly when **high-risk patients** are screened or when urine culture is done for other reasons
- Screening patients for asymptomatic bacteriuria is indicated for those at risk of complications of the bacteriuria is untreated. Such patients include:
  i. **Pregnant** women at 12 to 16 weeks' gestation or at the first prenatal visit
  ii. Patients who have had a **kidney transplant** within the previous 6 months
  iii. Young children with gross **VUR**
  iv. Before certain invasive **GU procedures** that can cause mucosal bleeding

CLASSIFICATION

ASYMPTOMATIC BACTERIURIA

- Certain patients (e.g., postmenopausal women; patients with controlled diabetes; patients with ongoing use of urinary tract foreign objects such as stents, nephrostomy tubes, and indwelling catheters) often have **persistent asymptomatic bacteriuria** and sometimes pyuria.
- If they are asymptomatic, these patients should not be screened
  routinely, because they are at low risk
- In patients with **indwelling catheters**, treatment of asymptomatic bacteriuria often **fails** to clear the bacteriuria and only leads to development of antibiotic-resistant organisms

CLASSIFICATION

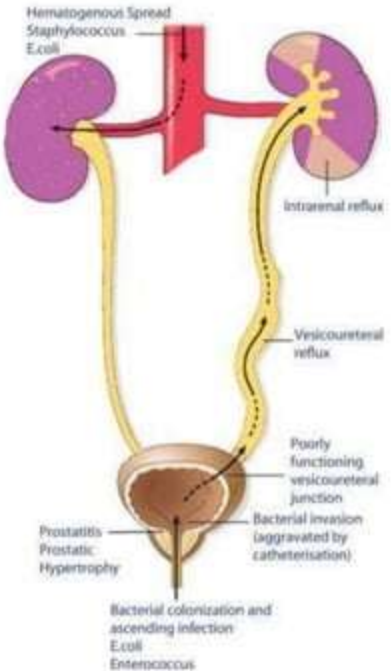
ACUTE PYELONEPHRITIS

- It's an infection of the **kidney parenchyma**
- In women, about 20% of community – acquired bacteremia are due to pyelonephritis
- Pyelonephritis is **uncommon** in men with a normal urinary tract
- The cause is commonly due to **ascension** of bacteria through the urinary tract
- Although obstruction predisposes to pyelonephritis, most women with pyelonephritis have no demonstrable functional or anatomic defects.
- In men, pyelonephritis is always due to some functional or anatomic defect
- Cystitis alone or anatomic defects may cause reflex
- The risk of bacterial ascension is greatly enhanced when ureteral peristalsis in inhibited

CLASSIFICATION

ACUTE PYELONEPHRITIS

- Pyelonephritis is common in **young girls** and in **pregnant** women after bladder catheterization
- Pyelonephritis is caused by **hematogenous** spread, which is particularly characteristic of virulent organisms
- **Papillary necrosis** may be evident in acute pyelonephritis associated with diabetes, obstruction, sickle cell disease, pyelonephritis in renal transplants, pyelonephritis due to candidiasis, or analgesic nephropathy
- Although acute pyelonephritis is frequently associated with renal scarring in children, similar scarring in adults is **not** detectable in the absence or reflux or obstruction



COMPLICATIONS

- **Recurrent infections**, especially in women who experience two or more UTIs in a six-month period or four or more within a year
- **Permanent** kidney damage from an acute or chronic kidney infection (pyelonephritis) due to an untreated UTI
- Increased risk in a pregnant women of delivering **low birth weight** or **premature infants**
- Urethral narrowing (**stricture**) in men from recurrent urethritis, previously seen with gonococcal urethritis
- **Sepsis**, a potentially life-threatening complication of an infection, especially if the infection its way up from urinary tract to kidneys

HISTORY TAKING

AGE AND GENDER

Can be all age and gender, more common in female due to short urethra, pregnancy women

CHIEF COMPLAINT

- Fever associated with chills and rigor
- Voiding
- Dysuria
- Urgency
- Frequency
- Burning micturation
- Oliguria
- Hematuria
- Suprapubic pain
- Abdominal pain

ASSOCIATED SYMPTOMS

Vomiting, malaise, loss of appetite, pallor

HISTORY TAKING

HISTORY OF

Sick contact, history of outside water activity and food intake, history of spermicide use

PAST MEDICAL HISTORY

- History of previous admission due to same condition
- History of obstruction (renal calculi)
- History of catheter use
- History of any systemic disease (Diabetes mellitus HIV)

PAST SURGICAL HISTORY

Any procedure or instrument involving urinary tract

PHYSICAL EXAMINATION

- ill looking patient
- Fever with chills and rigor
- Abdominal pain and tender
- Positive renal punch
- Distended bladder
- CVA tenderness (pyelonephritis)
- Urethral discharge (urethritis)
- Tender prostate on DRE (prostatitis)

INVESTIGATIONS

FULL BLOOD COUNT

- White cell count
- CRP

URINALYSIS

+ leukocyte esterase
+ nitrites
  More likely gram-negative rods
+ WBCs
+ RBCs

URINE C&S

- Positive urine culture >10^5 CFU/ml
- Escherichia coli
- Staphylococcus saprophyticus
- Proteus mirabilis
- Klebsiella
- Enterococcus

INVESTIGATIONS

RENAL FUNCTION TEST

- Creatinine
- Urea

OTHERS

- BUSE
- KUB x-ray
- Ultrasound
- Intravenous urography (IVU)
- Micturation Cystourethrogram (MCUG)
- Transrectal ultrasound biopsy
- MRI
- CT scan

INVESTIGATIONS

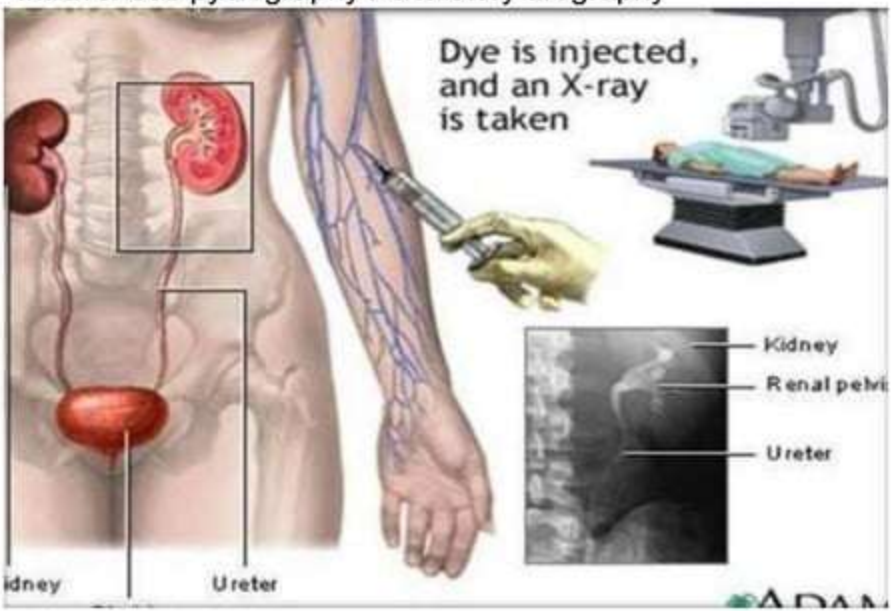
KUB X-ray

IVU

INVESTIGATIONS

DIAGNOSTIC TESTS FOR ADULTS WITH RECURRENT UTI

Intravenous pyelography / excretory urography



DIFFERENTIAL DIAGNOSIS

1. Acute pylonephritis
2. Acute cystitis
3. Urethritis
4. Acute prostatitis
5. Pelvic inflammatory disease

MANAGEMENT

ANTIBIOTICS

SUPPORTIVE TREATMENT, LIFESTYLE AND HOME REMEDIES

FOLLOW UP

INDICATIONS FOR HOSPITAL ADMISSION

- Severely ill or evidence of sepsis
- Presence of complications
- Concern about compliance
- Failure to respond to outpatient treatment
- Inability to maintain oral hydration or take medications, vomiting, dehydration
- Uncertainty about the diagnosis

Patients who do not meet the above categories may be considered for treatment on an **outpatient** basis

MANAGEMENT

ANTIBIOTICS

INFECTIONS/CONDITIONS & LIKELY ORGANISMS	SUGGESTED TREATMENT		COMMENTS
	PREFERRED	ALTERNATIVES	
ACUTE UNCOMPLICATED CYSTITIS E.coli Enterobacteriaceae: Klebsiella Proteus Enterobacter species Staphylococcus-saprophyticus Enterococcus	Nitrofurantoin 50mg PO q6h for 3 days	Amoxycillin/Clavulanate 625mg PO q8h for 3 days **OR** Cefuroxime 250mg PO q12h for 3 days	The choice of agents should be based on local culture and susceptibility results Nitrofurantoin should be used with caution in elderly and is contraindicated if GFR < 40 ml/min Duration of treatment should be up to 7 days in male
ACUTE CYSTITIS IN PREGNANCY	Nitrofurantoin 50mg PO q6h for 7 days **OR** Cefuroxime 250mg PO q12hr for 7 days	Cephalexin 500mg PO q12h for 7 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7 days	The choice of agents should be based on local culture and susceptibility results Avoid trimethoprim in pregnancy

MANAGEMENT

ANTIBIOTICS

INFECTIONS/CONDITIONS & LIKELY ORGANISMS	SUGGESTED TREATMENT		COMMENTS
	PREFERRED	ALTERNATIVES	
RECURRENT URINARY TRACT INFECTIONS PROPHYLAXIS: >3 episodes/year	Nitrofurantoin 50mg PO nocte for 3-12months **OR** Trimethoprim 100mg PO nocte for 3-12months	Trimethoprim/Sulphamethoxazole 80/400mg PO nocte for 3- 12months **OR** Cephalexin250mgPO ON for 3-12months	
ACUTE UNCOMPLICATED PYELONEPHRITIS E.coli, Enterobacter, Proteus Pseudomonas For patients **not** requiring hospitalization For patients requiring hospitalization	Ciprofloxacin 500mg PO q12hrs for 7 days with/ without an initial Ciprofloxacin 400mg stat IV Ceftriaxone 1-2gm q24h IV for 14 days with/without aminoglycoside. **OR** Amoxycillin/Clavulanate 1.2gm IV q8h for 14 days	Amoxycillin/Clavulanate 625mg PO q8h for 14 days Ciprofloxacin 400mg IV q12h for 7 days	The choice of agents should be based on local culture and susceptibility results May step down to oral antibiotic following clinical improvement (afebrile for 48 hours)

MANAGEME

ANTIBIOTICS

INFECTIONS/CONDITIONS & LIKELY ORGANISMS	SUGGESTED TREATMENT		COMMENTS
	PREFERRED	ALTERNATIVES	
ACUTE PYELONEPHRITIS IN PREGNANCY	Cefuroxime 750mg IV q8h for 14 days	Amoxycillin/Clavulanate 1.2gm IV q8h for 14 days **OR** Ceftriaxone 1-2gm IV q24h for 14 days	Avoid trimethoprim and fluoroquinolones in pregnancy
ASYMPTOMATIC BACTERIURIA	Trimethoprim 100mg PO q12hr for 7 days or 300mg PO q24h for 7 days **OR** Nitrofurantoin 50mg PO q6h for 7 days	Cefuroxime 250mg PO q12h for 7days	The choice of agents should be based on local culture and susceptibility results Avoid trimethoprim in pregnancy
ASYMPTOMATIC BACTERIURIA IN PREGNANCY	Nitrofurantoin 50mg PO q6h for 7 days **OR** Cefuroxime 250mg PO q12hr for 7 days	Cephalexin 500mg PO q12h for 7 days **OR** Amoxycillin/Clavulanate 625mg PO q8h for 7 days	Avoid trimethoprim and fluoroquinolones in pregnancy

MANAGEME

ANTIBIOTICS

INFECTIONS/CONDITIONS & LIKELY ORGANISMS	SUGGESTED TREATMENT		COMMENTS
	PREFERRED	ALTERNATIVES	
CATHETER-RELATED BACTERIURIA	Antibiotics not recommended for asymptomatic bacteriuria with indwelling urethral catheter		Remove or change catheter if possible. Only consider antimicrobial treatment if bacteriuria persists 48hrs after catheter removal

References:

1. The Sanford Guide To Antimicrobial Therapy 2011
2. Guidelines on Urological Infections, European Association of Urology 2014
3. IDSA Guidelines for the Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults 2005
4. International Clinical Practice Guidelines for the Treatment of Acute Uncomplicated Cystitis and Pyelonephritis in Women: A 2010 Update by the IDSA and European Society for Microbiology and Infectious Diseases 2011.
5. Sanford, Australian therapeutic guidelines on antibiotics

MANAGEMENT

SUPPORTIVETX, LIFESTYLE AND HOME REMEDIES

Urinary tract infections can be painful, but you can take steps to ease your discomfort until antibiotics treat the infection.

1. **Fever** can be treated with anti-pyretics
2. **Pain** can be treated with analgesics
3. **Drink plenty of water.** Water helps to dilute your urine and flush out bacteria.
4. **Avoid drinks that may irritate your bladder.** Avoid coffee, alcohol, and soft drinks containing citrus juices or caffeine until your infection has cleared. They can irritate your bladder and tend to aggravate your frequent or urgent need to urinate.
5. **Use a heating pad.** Apply a warm, but not hot, heatin
   minimize
   bladder pressure or discomfort.
6. **Cranberry juice –** may have infection fighting properti
   are not conclusive)

MANAGEMENT

1. Perform **urine analysis** to ensure that causative agent has been eradicated

1. A **urine culture** obtained 1-2 weeks after completing therapy & thereafter as clinically
   indicated may also be done

1. Further genitourinary investigation should be made in cases of:
   - Delayed or incomplete response to appropriate antimicrobial therapy
   - Early recurrence of infection after therapy

4. Further follow-up to identify & correct anatomical, functional or metabolic abnormalities
   is indicated

QUARIES?????

THANK YOU