

## Revision



Microbiology Team – 430

### Done By

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Comparison between Cystitis and acute pyelonephritis :

	Cystitis	Pyelonephritis
<b>Definition</b>	infection of the bladder; superficial mucosal infections	It is Bacterial infection of the renal pelvis, tubules and interstitial tissue of one or both kidneys
<b>Etiological agent</b>	<ul style="list-style-type: none"> <li>• <i>E. coli</i></li> <li>• <i>Enterobacteria (klebsiella , protus)</i></li> <li>• <i>S. saprophyticus</i></li> <li>• <i>P.aeruginosa</i>(usually with complicated UTI)</li> <li>• <i>Candida species</i>( with diabetic patient and catheterization )</li> <li>• Chlamydia</li> <li>• B strep ( in diabetic patient )</li> </ul>	<ul style="list-style-type: none"> <li>• urethra most bacterial causes bowel organisms eg Ecoli</li> <li>• Hospital-acquired infections: <i>staph</i> forms and enterococci</li> <li>• Hematogenous <i>S.aureus</i></li> <li>• <i>Pseudomonas aeruginosa</i></li> <li>• <i>Proteus mirabilis</i></li> <li>• <i>Klebsiella</i></li> </ul>
<b>Risk factors</b>	<p><b>In women</b></p> <ul style="list-style-type: none"> <li>• short urethra</li> <li>• pregnancy</li> <li>• decreased estrogen production during menopause</li> </ul> <p><b>In men:</b> mainly due to persistent bacterial infection of the prostate_</p> <p><b>In both sexes</b></p> <ul style="list-style-type: none"> <li>• bladder stone</li> <li>• urethral stricture</li> <li>• catheterization</li> <li>• diabetes mellitus</li> </ul>	<ul style="list-style-type: none"> <li>• Vesicoureteral reflux (VUR) common in children</li> <li>• Calculi</li> <li>• Urinary tract catheterisation</li> <li>• Pregnancy</li> <li>• Prostate disease</li> <li>• Immunocompromised states</li> <li>• Diabetes mellitus</li> </ul>
<b>Clinical presentation</b>	<ul style="list-style-type: none"> <li>• Dysuria</li> <li>• Frequency</li> <li>• Urgency</li> <li>• Hematuria</li> <li>• Usually no fever</li> <li>• Supra-pubic area</li> <li>• Bacteruria</li> <li>• Cloudy and malodorous urine</li> <li>• Older patient: confusion , hypothermia</li> </ul>	<ul style="list-style-type: none"> <li>• Chills</li> <li>• Fever</li> <li>• Flank pain</li> <li>• Renal angle tenderness</li> <li>• Pyuria</li> <li>• Dysuria</li> <li>• Frequency</li> <li>• Bacteriuria</li> </ul>
<b>Laboratory diagnosis</b>	<p>1- <u>Specimen collection:</u></p> <ul style="list-style-type: none"> <li>• Midstream urine ( MSU) <i>must be before starting antibiotic_</i></li> <li>• Supra-pubic aspiration used in children</li> </ul> <p>2- <u>Microscopic examination :</u></p> <ul style="list-style-type: none"> <li>• About 90% of patients have &gt; 10 WBCs /cu.mm</li> </ul> <p>3- <u>Chemical screening tests:</u></p> <p>Urine dip stick</p> <p>4- <u>Urine culture:</u> important to identify bacterial cause and antimicrobial sensitivity          .Quantitative culture : typical of UTI ( &gt;10<sup>5</sup>/cumm)</p>	<p><u>Urinalysis</u></p> <ul style="list-style-type: none"> <li>• 10 WBC/hpf</li> <li>• Positive result on leukocyte esterase</li> <li>• Positive nitrate dipstick test</li> <li>• Urine culture and sensitivity</li> <li>• Blood culture</li> </ul> <p><u>Radiological investigations</u></p> <ul style="list-style-type: none"> <li>• CT scan</li> <li>• IVP=intra venous pyelogram</li> </ul>

Treatment	<b>Course:</b> 3-7 days (uncomplicated ) 10-14 days (complicated , recurrent cystitis)	<b>Course:</b> 10-14 days
	<b>Nitrofurantoin</b> Ciprofloxacin TMP/SMX	<b>Mild or moderate symptoms:(oral treatment):</b> Fluoroquinolone TMP/SMX, if uropathogen is known to be susceptible <b>Gram-positive pathogen(enterococcus faecalis):</b> amoxicillin, or amoxicillin-clavulanate <b>Hospitalized patients:( IV Then orally):</b> <ul style="list-style-type: none"> <li>– ciprofloxacin IV, then orally</li> <li>– Gentamycin ± ampicillin IV, then TMP/SMX (orally)</li> </ul>

### Cystitis summary :

- UTI patients present with urinary symptoms and significant bacteruria =  $10^5$  bacteria/ml
- Cystitis more common in women than in men because they have short urethra, pregnancy and decrease estrogen production during menopause.
- S. aureus can cause UTI by Hematogenous spread (through blood stream ) from other of infection.
- E coli is the most common cause of cystitis (complicated and uncomplicated)
- Staphylococcus saprophyticus can cause honeymoon cystitis (usually affect sexually active female (from 18-45 years)).
- The patient who has cystitis usually come with no fever
- Interstitial cystitis is autoimmune attack , so there is no bacteria in the urine and the patient doesn't response to antibiotic.
- Catheter urine should not be used for diagnosis of UTI.
- Urine dip stick is auseful chemical test to detect nitrate (which produced by gram (-) bacteria) and leukocyte esterase
- Urine culture: important to identify bacterial cause and antimicrobial sensitivity
- In recurrent cystitis we should do investigation such as Intravenous Urogram (IVU) OR ultrasound.
- Nitrofurantoin can be used only with lower urinary tract infection like cystitis .
- Supra-pubic aspiration is used with children
- The best specimen collection used for cystitis diagnosis is MSU (midstream urine).

### Pyelonephritis summary :

- ☀• Pyelonephritis is Bacterial infection of the renal pelvis, tubules and **interstitial tissue** of one or both kidneys
- ☀• Pyelonephritis is a **systemic infection** that's why we do **blood culture**, and it's most common in females. (because of their short urethra).
  - **prostatic enlargement** is the common cause of pyelonephritis in men
  - The VUR is the most common cause of the pyelonephritis in children
- ☀• The patient who has usually come with **flank pain, chills and fever**, then you examine the urine looking for **pus cells**.
- ☀• Most of the bacteria come from **the gut** and the commonest cause of infection is **E.Coli**. on the other hand the commonest **gram positive** bacteria is **enterococci**, and **S. saprophyticus** cause the **Honeymoon cystitis**.
  - Structural abnormalities to the kidneys and urinary tract is a one of the risk factor of UTI
  - Infection usually **ascends** from the **urethra**
  - Complications of pyelonephritis are **End Stage Renal Disease, hypertension and kidney stone**.
  - In the infant, the presentation(symptom) may be **feeding difficulty or fever**.
  - In the elderly presentation may be **mental status change like confusion and hypothermia**.
  - Medical management should be according to **culture and sensitive result**.
  - The duration of treatment of pyelonephritis from **10-14 days**
- ☀• Some bacteria come from the blood (Hematogenous) like Staph.Aureus. Once you find it in urine you should look for associated infection in other organs (like abscess)
- ☀• **Proteus mirabilis** is non lactose forming organism & it breaks down urea giving ammonia which makes the **urine Alkaline**



## Treatment of urinary tract infection :

- ☀• In case of asymptomatic bacteruria (no symptoms but bacterial count high) , we don't treat Pt. **except if she is pregnant or Pt in the O.R or after transplantation.**
- Duration of antibiotics:
  1. **Cystitis** either complicated or uncomplicated → **3 to 7 days.**
  2. **Pyelonephritis** either complicated or uncomplicated → **10 to 14 days.**
- E.coli is the most resistant against ampicillin & the least resistant to Nitrofurantoin, ciprofloxacin & Co-trimoxazole.
- Drugs that we use in UTI:
  - Ampicillin, Gentamicin, Cephalosporin (first & second generation), Nitrofurantoin, Doxycycline (used in urethritis against Chlamydia), fluoroquinolone or Co-trimoxazole.
- ☀➤ **Enterococcus faecalis is resistant to all these drugs except ampicillin (because it's the only gram + bacteria).**
- Postcoital antibiotics :
  - **A single preventive dose taken immediately after intercourse.**
- Pregnant women :
  - ☀ - Pregnant women should **NOT** take Quinolone(**Fluoroquinolone**),or **Nitrofurantoin in the last 2 weeks of pregnancy.**
  - Pregnant women with asymptomatic bacteruria have 30% risk for acute pyelonephritis, **that's why we have to treat her immediately with antibiotics.**
- **UTI in children** is serious because they might have VUR which can lead to pyelonephritis & kidney damage.
  - **Surgery used to correct VUR and antibiotics used to prevent infections.**
- catheter-induced UTI
  - **Catheter should not be used unless absolutely necessary and they should be removed as soon as possible.**
  - **Catheterized patients who develop symptomatic UTI are at risk for sepsis & should be treated for each episode with antibiotics + remove catheter if possible.**
- ☀• Patients with two or more symptomatic UTIs within 6 **need preventive therapy.**
- Choice of antibiotic depend on **susceptibility pattern.**

### The Drugs:

1. Cephalosporin:
  - First generation: Cephalexin & cephadrin.
  - Second generation: cephuroxim axetil
  - 3<sup>rd</sup> generation: ceftriaxone & cefaxim.
2. Fluoroquinolone:
  - Ciprofloxacin, norfloxacin, Gatifloxacin, moxifloxacin.

## Cases

### Case 1

A 25 years old non pregnant female presented with **dysuria** , **frequency** and **urgency**. Urine sample was recommended and it appeared **cloudy** and **malodorous**. And **blood** was found in the urine.

Under the microscopy **WBCs** were **more than 10/HPF** also **bacteria** was found (bacteriuria).

The patient was diagnosed to have uncomplicated UTI (cystitis).

For treatment she was given Ampicillin for **3 days**.

What is the urine sample that should be used for diagnosis?

- **Midstream Urine (MSU)**

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### Case 2

A 33 years old pregnancy women presented to the emergency with high **fever** , **chills** and **there is flank pain** . She has complained of **dysuria** and **frequency** for the last 24 hours . her urine analysis positive to bacteriuria and pyuria. She was diagnosed to have acute pyelonephritis .

- **which of the following drugs are contraindications:**
- Nitrofurantoin (only contraindicate in the last 2 weeks).
- TMP-SMX
- **Fluoroquinolone.**

### Case 3

diabetic pregnant women came to gynecology for follow up, without any symptoms, and when we did the urine culture, we found a significant bacteriuria.

- She is having??
    - Asymptomatic bacteriuria.
  - Should we treat her???
    - Yes because she has a 30% risk for acute pyelonephritis in the second or third trimester.
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### Case 4

Patient was diagnosed with acute urinary retention & he had a urinary catheterization as a part of the management. Now he is recovered from this disease but he has developed UTI. The best choice of his treatment is:

- Co- trimoxazole
- Gentamicin.
- Remove the catheter.