



# PYELONEPHRITIS

Microbiology Team 434



## Definition:

- It is Bacterial infection of the renal pelvis, tubules and interstitial tissue of one or both kidneys.
- Potentially organ and/or life-threatening infection that characteristically causes some scarring of the kidney with each infection and may lead to significant damage to the kidney that may lead to hypertension.
- Pyelonephritis may be acute or chronic.

## Pathophysiology and etiology:

- Infection usually ascends from the urethra.
- Frequently due to ureterovesical reflux.
- Most causative organism: Ecoli (70-80%).
- Hospital-acquired infections may be due to: Coliforms and Enterococci.
- Haematogenous spread is rare: e.g. Staph aureus and Mycobacterial tuberculosis.

## Pathology:

- Kidneys enlarge.
- Interstitial infiltration of inflammatory cells.
- Abscesses on the capsule and at corticomedullary junction.
- Destruction of tubules and the glomeruli.
- If chronic, kidneys become scarred, contracted and nonfunctioning.

## Pathogenesis:

- Rectal and/or vaginal reservoirs.
- Colonization of perianal area.
- Bacterial migration to perivaginal area.
- Bacteria ascend through urethra to bladder.
- Intercourse may contribute urethral colonization and ascending infection.
- ASB[asymptomatic bacteruria] in 1st trimester of pregnancy may cause pyelonephritis in 3rd trimester.

# Acute Pyelonephritis

## Clinical Manifestations:

**Symptoms develop rapidly (<24 hours) and may include:**

- Acutely ill
- Chills
- Fever >38°C
- Flank pain and
- Nausea/vomiting
- Renal angle tenderness
- Confusion in elderly
- Leukocytosis
- Pyuria
- Bacteriuria

**In addition symptoms of lower tract involvement :**

- Dysuria
- Frequency

## Diagnosis:

- Is not always straightforward.
- A number of studies using immunochemical markers have shown that many women, who initially present with lower tract symptoms, actually have pyelonephritis.
- The extremes of age, the presentation may be so atypical in the very young (feeding difficulty or fever).
- In the elderly presentation may be mental status change like confusion or fever.

## laboratory diagnosis:

### Urinalysis:

- 10 WBC/hpf is the usual upper limit of normal.

### Dipstick test:

1. Positive result on leukocyte esterase correlates well for detecting >10 WBC/hpf, with a specificity of 65%–95%, and sensitivity of 75%–95%.
2. Positive nitrate result for bacteriuria[ bacteria reduce nitrate to nitrite]is only moderately reliable; false-negative results are common.

### Urine culture and sensitivity.

**Blood culture important as this is asystemic infection.**

## Clinical Manifestations:

### Mechanical:

- Structural abnormalities to the kidneys and the urinary tract vesicoureteral reflux (VUR) especially in young children.
- Calculi .
- Urinary tract catheterization.
- Nephrostomy.
- Pregnancy.
- Neurogenic bladder (e.g. due to spinal cord damage, spina bifida or multiple sclerosis).
- Prostate disease (e.g. benign prostatic hyperplasia) in elderly men.
- Bladder tumors.
- Urethral strictures.

### Constitutional:

Diabetes mellitus,  
Immunocompromised states.

## Radiological investigations

- CT scan.
- IVP=intra venous pyelogram.
- Radionucleotide imaging with gallium citrate and indium-111-labeled WBCs.



✓ Micturiting cystourethrogram (MCW showing bilateral VUR, grade IV on right and grade III on left-side. There is bilateral ureteral and pelvic dilation with blunting of fornices in the right kidney.



✓ Bilateral reflux extending into the pelvicalyceal systems of the kidney without dilatation of the calyces or ureters. (note catheter in bladder).

## Medical Management:

- Treated as outpatients if there is no nausea, vomiting or dehydration and other signs and symptoms of sepsis.
- Very ill patients and all pregnant women are hospitalized at least for 2 to 3 days for parenteral therapy.
- 2 weeks course.
- Bactrim.
- Ciprofloxacin.
- Gentamicin with or without amoxicillin.

- ✓ **Problems:**
- Chronic or recurring symptomless infection persisting for months or years.
  - Another 6 weeks course if relapse.
  - Follow up urine culture 2 weeks after completion of therapy.

Complicated UTI Etiology	(%)
• <i>Escherichia coli</i>	21 – 54
• <i>Klebsiella pneumoniae</i>	1.9 – 17
• <i>Enterobacter species</i>	1.9 – 9.6
• <i>Citrobacter species</i>	4.7 – 6.1
• <i>Proteus mirabilis</i>	0.9 – 9.6
• <i>Providencia species</i>	18
• <i>Pseudomonas aeruginosa</i>	2 – 19
• <i>Enterococci species</i>	6.1 – 23



# Chronic Pyelonephritis

Repeated bouts of acute pyelonephritis may lead to chronic pyelonephritis that may lead to kidney damage and hypertension.

## ✓ Clinical manifestations:

- No symptoms of infection unless an acute exacerbation occurs.
- Fatigue.
- Head ache.
- Poor appetite.
- Polyuria.
- Excessive thirst.
- Weight loss.

Progressive scarring → renal failure

## Assessment and diagnostic findings:

- IVP.
- Serum creatinine .
- Blood urea.
- Culture and sensitivity test

## Complications:

- ESRD=end stage renal disease.
- Hypertension.
- Kidney stones.

## Medical management:

- According to culture and sensitivity result.
- Drugs carefully titrated if renal function is impaired.

## Nursing management:

- Fluid balance – I / O chart.
- Fluids encouraged unless contraindicated.
- 4th hourly temp.
- Antibiotics.
- Bed rest.
- Teach how to prevent recurrent infections : adequate fluids, emptying the bladder regularly and performing recommended perineal hygiene taking antibiotics as prescribed.

# Treatment:

Eradicate pathogens in kidney and urothelium, and treat/prevent bacteremia

## Mild or moderate symptoms:

- Outpatient treatment (total of 7–14 days) oral treatment:
  - Fluoroquinolone.
  - TMP/SMX, if uropathogen is known to be susceptible.

## Hospitalized patients:

- IV antibiotic first 48–72 hours followed by 7 days of oral antibiotic therapy:
  - Fluoroquinolone IV, then PO (orally).
  - Aminoglycoside ± ampicillin IV, then TMP/SMX PO(orally).
  - Third-generation cephalosporin IV, then TMP/SMX PO(orally).

## Ambulatory patients:

- 7–14 days of PO(orally) therapy with one of the antimicrobials above.



# MCQs

1. One of pyelonephritis complications is:  
a) Vasculitis   b) Nephritic syndrome   c) Hypertension   d) Dehydration
2. Most common pathway to get infection of pyelonephritis  
a) From GIT (ascending pathway:urethral contamination from rectum)  
b) Hematogenous  
c) From needle
3. A patient has pyelonephritis. From history she got infected hematogenously. What do you think the most common cause in this pathways  
a) E.coli + Klebsiella   b) TB + E.coli   c) TB + S.aureus   d) Psuedomonas + Cribsilla
4. What is the most common gram positive microbe causes pyelonephritis?  
a) E.coli   b) S.aureus   c) Enterbacter species   d) Enterococcus species

1) C, 2) A, 3)C, 4)D

# MCQs

5. An asymptomatic 84-year old male with an indwelling foley catheter. The organism was resistance to some drugs. What do you think the etiology in this case?
- a) *Pseudomonas arginosa*   b) *Proteus mirabilis*   c) *Candida*   d) Viral infection
6. In Q5. What is the best antibiotic used to treat this case?
- a) Nitrofurantoin   b) Vancomycin   c) Azithromycin   d) Ciprofloxacin
7. There are two drugs not used in case of pyelonephritis:
- a) Nalidixic acid + Nitrofurantoin   b) Amoxicillin + clavulanic acid  
c) levofloxacin + Doxycycline   d) TMP + SMX
8. How long does it take to treat complicated pyelonephritis:
- a) 1-3 months   b) 1-3 days   c) 1-2 weeks   d) 7-14 weeks

5)A, 6)D, 7)A, 8)C





# THANK YOU

Done by:  
Microbiology team

**“THERES  
NO ELEVATOR  
TO SUCCESS.  
YOU HAVE  
TO TAKE  
THE STAIRS.”**

Author Unknown