

Microbiology Team

Urinary Tract Infections

PYELONEPHRITIS



Team Members:

Dalal Fatani

Noha Khalil

Sameeha AlJetaily

Haifa AlAbdulkarim

Abeer AlSwaillem

Noura AlSwaidan

Jumana AlShammari

Maymona Alabdely

Jazeel Almulla

● **Very Important**

● **Important**

● **Explained by the doctor**

Team Members:

Faisal Al Rashed

Abdullah Al Turki

Abdullah Al Sulaimani

Ghassan Al Kharboush

Abdullah Al Sufiani

Abdullah Baqais

- Pyelonephritis 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.
- Infection usually ascends from the urethra.
- **Most bacterial causes are bowel organisms e.g. Ecoli (70-80%). ← VERY IMPORTANT!**
- Hospital-acquired infections may be due to coliforms and enterococci.
- Hematogenous spread is rare e.g. Staphylococcus aureus.
- Frequently due to ureterovesical reflux.
- Pyelonephritis can be Acute or chronic.
- Nitrofurantoin cannot be used to treat Pyelonephritis.

▣ Etiology:

	%
▪ Escherichia coli	21 – 54
▪ Klebsiella pneumoniae	1.9 – 17
▪ Enterobacter species	1.9 – 9.6
▪ Citrobacter species	4.7 – 6.1
▪ Proteus mirabilis	0.9 – 9.6
▪ Providencia species	18
▪ Pseudomonas aeruginosa	2 – 19
▪ Enterococci species	6.1 – 23

▣ Pathology:

Kidneys enlarge. interstitial infiltration of inflammatory cells. Abscesses on the capsule and at corticomedullary junction. Result in destruction of tubules and the glomeruli. When 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) in 1st trimester of pregnancy may cause pyelonephritis in 3rd trimester.

▣ Clinical Manifestations of acute Pyelonephritis:

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

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

♣ In addition symptoms of lower tract involvement:

- | | |
|-----------|-------------|
| ▪ Dysuria | ▪ Frequency |
|-----------|-------------|

■ Risk Factors:

- Mechanical:
 - Structural abnormalities to the kidneys and the urinary tract
 - vesicoureteral reflux (VUR) especially in young children.
 - calculi
 - urinary tract catheterisation
 - neurogenic bladder (e.g. due to spinal cord damage, spina bifida or multiple sclerosis) and **prostate disease** (e.g. benign prostatic hyperplasia) in men
 - bladder tumours
 - nephrostomy
 - **pregnancy**
 - urethral strictures
- Constitutional:
 - diabetes mellitus, Immunocompromised states.

■ 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 (feeding difficulty or fever).
- In the elderly presentation may be mental status change or fever.

■ Laboratory Diagnosis of Pyelonephritis:

♠ Urinalysis:

- **10 WBC/hpf is the usual upper limit of normal.**
- **Positive result on leukocyte esterase dipstick test correlates well for detecting >10 WBC/hpf, with a specificity of 65%–95%, and sensitivity of 75%–95%.**
- **Positive nitrate reduction test dipstick test result for bacteriuria is only moderately reliable. false-negative results are common. (Some Bacteria converts Nitrate to Nitrite).**
- Urine culture and sensitivity.
- Blood culture. **(Because it is a systemic infection, we don't do this procedure in cystitis).**

If the urine is Alkaline, the leukocyte might be broken so we may not find WBCs. But we cannot exclude Pyelonephritis. This is why we have to check leukocyte esterase levels in the urine. Remember, some organisms like **Proteus mirabilis** convert the PH of urine to alkaline. In contrast, RBCs are broken in Acidic urine.

■ Radiological investigations:

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

■ 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 (Not less than 10 Days)
 - Bactrim [trimethoprim /sulpha]
 - Ciprofloxacin (It is contraindicated in Pregnancy; Ciprofloxacin is used especially with pseudomonas).
 - Gentamicin with or without amoxicillin
 - We cannot use Nitrofurantoin.
- ✓ 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.

■ Chronic Pyelonephritis:

- Repeated bouts of acute Pyelonephritis may lead to chronic Pyelonephritis.
- Clinical manifestations:
 - No symptoms of infection unless an acute exacerbation occurs
 - Fatigue
 - Head ache
 - Poor appetite
 - Progressive scarring → renal failure → Hypertension
 - Polyuria
 - Excessive thirst
 - Weight loss

■ Assessment and diagnostic findings:

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

■ Complications:

- End Stage Renal Disease
- Hypertension
- Kidney stones

■ Medical management:

- According to C&S result (Culture and sensitivity).
- Drugs carefully titrated if renal function is impaired.

■ Treatment Guidelines:

- Acute Uncomplicated Pyelonephritis
 - Mild or moderate symptoms:
 - Outpatient treatment (total of 7–14 days)
 - oral treatment:
 - Fluoroquinolone
 - TMP/SMX, if uropathogen is known to be susceptible
 - If Gram-positive pathogen: amoxicillin or amoxicillin-clavulanate.
 - Ampicillin, TMP/SMX and cephalosporins are safe antibiotics.
- ✓ Eradicate pathogens in kidney and urothelium, and treat/prevent bacteremia.

■ **Hospitalized patients:**

- IV antibiotic first 48–72 hours followed by 7 days of oral antibiotic therapy:
- Fluoroquinolone IV, then PO.
- Aminoglycoside ± ampicillin IV, then TMP/SMX PO.
- Third-generation cephalosporin IV, then TMP/SMX PO.
- Ambulatory patients: 7–14 days of PO therapy with one of the antimicrobials above.

♠ **QUESTIONS** ♠

Which of the Following is the most common organism can cause Pyelonephritis?

- A. Staphylococcus Saprophyticus
- B. E Coli
- C. Pseudomonas
- D. Group A Streptococci

Which of the following antibiotics cannot be used for Pyelonephritis?

- A. Ciprofloxacin
- B. Ceftriaxone
- C. Nitrofurantoin
- D. TMP/SMX

Ans: B, C