

PYELONEPHRITIS

Introduction	<ul style="list-style-type: none"> One urinary tract infection is not enough to cause kidney disease, it has to be recurrent. This typically happens during childhood. Recurrent infection mostly will end by fibrosis. Acute pyelonephritis most of the time this is a self limiting disease. Chronic pyelonephritis leads to serious kidney disease that ends by kidney failure.
Definition	<ul style="list-style-type: none"> 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. Kidney disease can cause 2 things: Hypertension + Renal failure.
Pathophysiology and aetiology	<ul style="list-style-type: none"> Infection usually ascends from the urethra, most bacterial causes bowel organisms eg. E.coli (70-80%) Hospital-acquired infections may be due to coliforms and enterococci. Haematogenous spread is rare eg. Staph aureus and mycobacterial tuberculosis Frequently due to ureterovesical reflux (<i>usually in children, might happen asymptotically</i>)

Complicated UTI Etiology

*It is important to know the classification of renal tract infection in general :
Complicated OR Non-Complicated*

<ul style="list-style-type: none"> Escherichia coli 	21 – 54 %	<ul style="list-style-type: none"> Proteus mirabilis 	0.9 – 9.6 %
<ul style="list-style-type: none"> Klebsiella pneumoniae 	1.9 – 17 %	<ul style="list-style-type: none"> Providencia species 	18 %
<ul style="list-style-type: none"> Enterobacter species 	1.9 – 9.6 %	<ul style="list-style-type: none"> Pseudomonas aeruginosa - <i>usually from hospital</i> 	2 – 19 %
<ul style="list-style-type: none"> Citrobacter species 	4.7 – 6.1 %	<ul style="list-style-type: none"> Enterococci species 	6.1 – 23 %

Pyelonephritis may be acute or chronic

Pathology	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 bacteriuria] 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
- Chills
- Fever >38°C
- Flank pain
- Nausea/vomiting
- Renal angle tenderness
- Confusion in elderly
- Leukocytosis
- Pyuria
- Bacteriuria

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
- nephrostomy
- pregnancy
- neurogenic bladder (due to spinal cord damage, spina bifida or multiple sclerosis)
- prostate disease (benign prostatic hyperplasia) in elderly men
- bladder tumours
- 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 in the very young (feeding difficulty or fever)
- In the elderly presentation may be mental status change like confusion 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 nitrite dipstick test 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 a systemic infection
- Pyelonephritis is characterized by bacteremia so it is very important to do a blood culture.

Radiological investigations

- CT scan
- IVP = intravenous pyelogram (*IVP is a radiological exam using contrast*)
- Radionuclide imaging with gallium citrate and indium-111-labeled WBCs

Micturating cystourethrogram (MCU) showing

- bilateral VUR
- grade IV on right
- 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

Problem

- 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** that may lead to kidney damage and hypertension.

Clinical manifestations

- No symptoms of infection unless an acute exacerbation occurs
- Fatigue
- Headache
- Poor appetite
- Polyuria
- Excessive thirst
- Weight loss
- Progressive scarring → renal failure

Assessment and diagnostic findings

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

Complications

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

Medical management

- According to C&S 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 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

Treatment of Pyelonephritis

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

- Scarred and contorted kidneys (*chronic*)
- Destruction of approximately 70% of the kidney. Numerous dilated calyces with yellow-brown calculi. The central necrotic areas are surrounded by dense fibrosis.