

Pyelonephritis

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

Pathophysiology and aetiology

- Infection usually ascends from the urethra most bacterial causes bowel organisms eg Ecoli (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

Complicated UTI 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

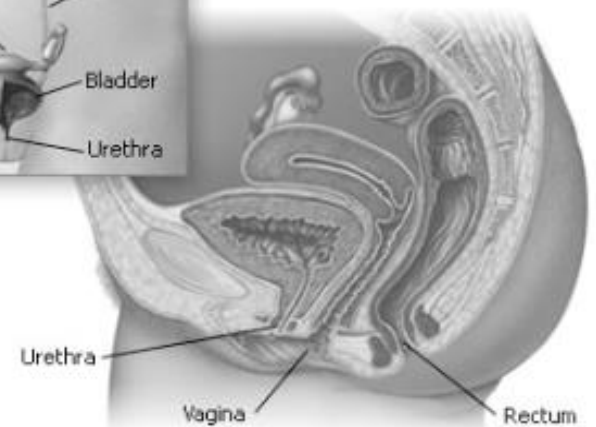
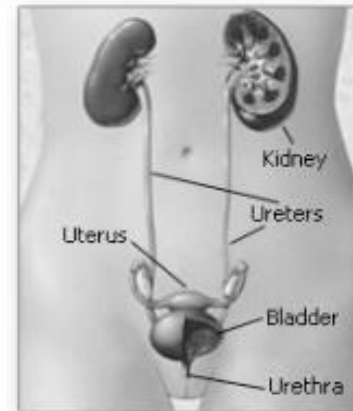
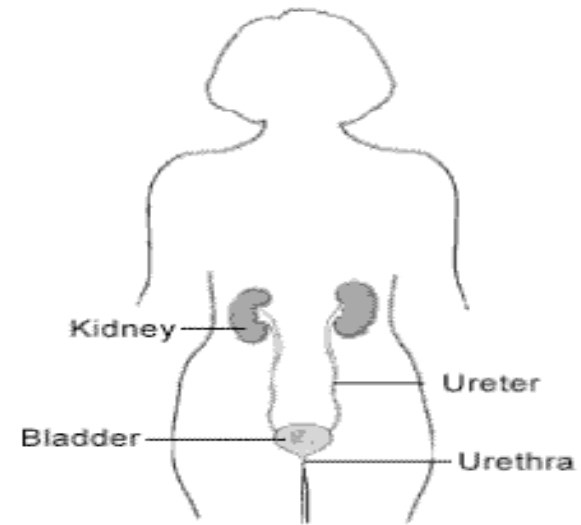
Pyelonephritis may be acute or chronic

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 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 and
- 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 (e.g. due to spinal cord damage, spina bifida or multiple sclerosis) and
 - prostate disease (e.g. 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 nitrate 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 asystemic infection

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

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
- 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

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



Destruction of approximately 70% of the kidney. Numerous dilated calyces with yellow-brown calculi. The central necrotic areas are surrounded by dense fibrosis.



Case 1

- You are contacted by a resident regarding the use of a FQ[FLUORQUINOLONES]
- in a 24 year old semi-professional soccer player with an
- apparent UTI.
- he has complained of dysuria and frequency for the last 24 hours. Hi UA is positive for bacteria using a nitrate
- dipstick and WBC's using a dipstick esterase test.
- His past medical history is significant for DM. he has no
- allergies other than his diabetes there has been no
- other significant medical problems.

Case 2

An asymptomatic 84 year old male with hypertrophy of the prostate has an indwelling foleys catheter has a positive urine culture for *P. aeruginosa*. You have been contacted regarding the appropriate dose and interval for ciprofloxacin to begin therapy.

Case 3

You have been consulted on a 72 year old female nursing home patient. She recently was treated for 10 days with ceftriaxone and azithromycin for presumed CAP. During her hospitalization a foley catheter was placed. She is currently afebrile and asymptomatic of any UTI symptoms but a culture of her urine at the end of her antibiotic therapy had a significant growth of yeast. How should she be managed?