

Acute Pyelonephritis

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Objectives

- ▶ Define pyelonephritis
- ▶ List risk factors
- ▶ Discuss the etiology and pathogenesis
- ▶ Describe signs and symptoms
- ▶ List potential complications
- ▶ Discuss the diagnosis, management and prevention

UTI Terminology

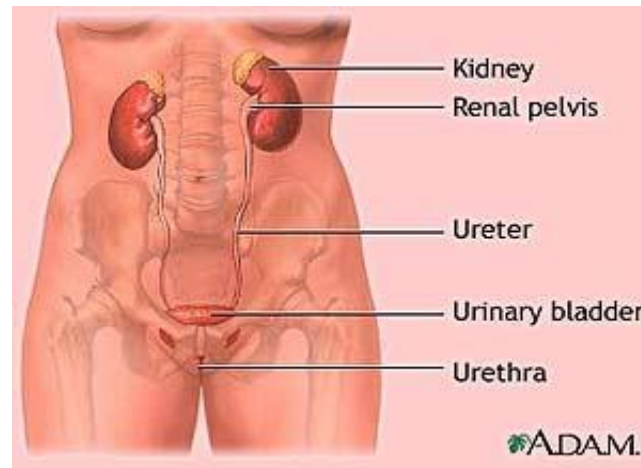
- ▶ **Uncomplicated:** infection of urinary bladder in host w/out underlying renal or neurologic disease.
- ▶ **Complicated:** infection in setting of underlying structural, medical or neurologic disease.
- ▶ **Recurrent:** Patients with two or more symptomatic UTIs within 6 months or 3 or more over a year.
- ▶ **Reinfection:** recurrent UTI caused by different pathogen at any time or original infecting strain >13 days after therapy of original UTI.
- ▶ **Relapse:** recurrent UTI caused by same species causing original UTI w/in 2 weeks after therapy.

Introduction

- ▶ It is very serious condition that can lead to renal scarring, nephric, perinephric abscess formation, sepsis
- ▶ Clinical presentation is atypical in some patients

Definition

- ▶ It is Bacterial infection of the renal pelvis, tubules and interstitial tissue of one or both kidneys



- Renal pelvis: pyelitis
- Renal parenchyma: pyelonephritis
- Bladder: cystitis
- Urethra: urethritis

Risk Factors

- ▶ Pregnancy
- ▶ Diabetes
- ▶ Immunosuppression
- ▶ Obstruction
- ▶ Catheterized patients

Etiology

- ▶ *Escherichia coli*, accounts for 70-90% of uncomplicated UTIs and 21-54% of complicated UTIs.
- ▶ Uropathogenic *E. coli* (UPEC): Have enhanced potential to produce UTI.
- ▶ UPEC genes encode several virulence factors including:
 - ▶ Type 1 pilli
 - ▶ P pilli
 - ▶ Alpha hemolysin
- ▶ *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterococci*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Enterobacter* species.
- ▶ Rare *candida*, *viruses*, *Brucella* and *TB*.

Pathogenesis

- ▶ Ascending bacterial infection
- ▶ Hematogenous spread to kidney is rare
 - ❖ Exception: neonates with *Staphylococcus aureus*
- ▶ For optimal host defense function, intermittent & complete emptying of bladder must occur
 - ❖ Urine is excellent culture medium
 - ❖ Bactericidal secretion from uroepithelial cells and glycoproteins inhibit bacterial adherence
- ▶ Renal parenchyma infections result in inflammatory response to contain infection but contributes to potential scarring

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

Symptoms and Signs

- ▶ Acute pyelonephritis may be unilateral or bilateral
- ▶ Flank pain (pain in the costovertebral angle)or tenderness or both, fever, chill and lower urinary tract symptoms (urgency, frequency and dysuria)
- ▶ Azotemia can occur
- ▶ Other non infectious causes of these symptoms is renal infarct and calculi

- ▶ In the chronic phase the patient may show unremarkable symptoms such as nausea and general malaise
- ▶ Systemic signs occur as a result of the chronic disease: elevated BP, vomiting, diarrhea.

Differential Diagnosis

- ▶ Acute pelvic inflammatory disease
- ▶ Ectopic pregnancy
- ▶ Diverticulitis
- ▶ Renal calculi

Complications

- ▶ Hypertension, septic shock, multi organs failure, death
- ▶ Renal or perinephric abscesses
- ▶ Metastatic infection
- ▶ Papillary necrosis
- ▶ Acute renal failure
- ▶ Emphysematous pyelonephritis
- ▶ Renal gangrene
- ▶ Localized or generalized atrophy/permanent loss of function

Diagnosis

- ▶ Urinalysis and microscopy: bacteria ($10^8/l$ or $10^5/ml$) and pus $\geq 10/HPF$ (90%) and leukocytes esterase , RBCS 20-40% in the urine and leukocytosis
- ▶ A clean-catch or catheterized quantitative urine culture on BAP and selective media and sensitivity identifies the pathogen and determines appropriate antimicrobial therapy
- ▶ Ultrasound or CT scan

Diagnosis

- ▶ Blood culture 15-30%
- ▶ BUN and Creatinine levels of the blood and urine may be used to monitor kidney function
- ▶ IVP will Identify the presence of obstruction or degenerative changes caused by the infection process
- ▶ Ultrasound or CT scan

Management

- ▶ Patients with mild signs and symptoms may be treated on an outpatient basis with antibiotics for 7-14 days
- ▶ Hospitalization in sever cases
- ▶ Treatment options include: fluoroquinolones (ciprofloxacin), TMP-SMX, aminoglycoside (gentamicin) with or without ampicillin or third generation cephalosporins (ceftriaxone).
- ▶ Pipracillin/tazobactam or carbapenems in sever cases with risk of resistant bacteria
- ▶ Antibiotics are selected according to results of urinalysis culture and sensitivity and may include broad-spectrum medications

Prevention

- ▶ Antimicrobial prophylaxis
- ▶ TMP-SMX 3/week or nitrofurantoin daily
- ▶ Intravaginal estradiol
- ▶ Cranberry juice
- ▶ Removal the urinary catheter as soon as possible or use condom catheter

Prognosis

- ▶ Prognosis is dependent upon early detection and successful treatment.
- ▶ Baseline assessment for every patient must include urinary assessment because pyelonephritis may occur as a primary or secondary disorder.