



Lecture – 1

Pyelonephritis



Microbiology team 430

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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. (Which mean that it could be harmful only to the kidney or /& harmful to the all body).

Pathophysiology and etiology

- Infection usually **ascends** from the urethra, most bacterial causes bowel organisms **e.g. E.coli (70-80%)**.
- Hospital-acquired infections may be due to coliforms and Enterococci. (Enterococci are group D strept).
- **Hematogenous spread is rare e.g. Staph aureus and mycobacterial tuberculosis.**

So, if I have discovered that the infection is by staph. Aureus, I should think of Hematogenous spread. (to the kidney , bones , heart or lungs

- Frequently due to ureterovesical reflux (movement of flow of urine from the bladder to the kidneys)

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> • <i>Proteus mirabilis</i> is non lactose forming organism & it breaks s down urea by urease enzyme giving ammonia which makes the urine Alkaline. So, if we find alkaline urine we should think of <i>Proteus mirabilis.</i> Alkaline urine participates in the forming of phosphate crystals & then kidney stones which is a reason of UTI.	0.9 - 9.6
• <i>Providencia species</i>	18
• <i>Pseudomonas aeruginosa</i>	2 – 19
• <i>Enterococci species. (group D faecalis)</i>	6.1 - 23

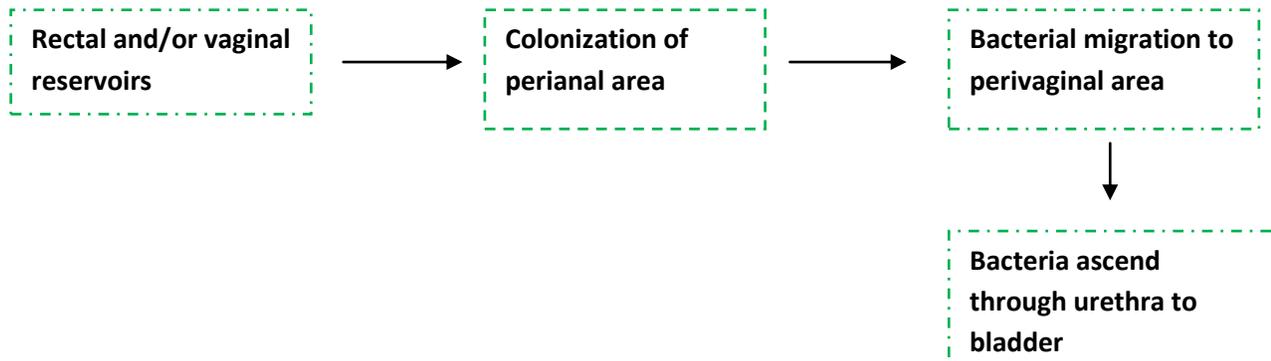
N.B: Pyelonephritis may be acute or chronic.

Pathology

- Kidneys enlarge
- Interstitial infiltration of inflammatory cells. **Especially, neutrophils.**
- **Abscesses on the capsule and at corticomedullary junction.**
- Result in destruction of tubules and the glomeruli.
- In chronic pyelonephritis kidneys become scarred, contracted and nonfunctioning

Pathogenesis:

- Rectal and/or vaginal reservoirs
- Colonization of perianal area (**spreading of bacteria around the anus and the Perianal area is the initial area of infection**).
- 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.



Risk factors

- Mechanical:
 - **Structural abnormalities to the kidneys and the urinary tract.**
 - **Vesicoureteral reflux (VUR) especially in young children. Young male children.**
 - **Calculi**
 - **Urinary tract catheterization**
 - **Nephrostomy (artificial opening created between the kidney & the skin which allows for the drainage of urine directly from the kidney).**
 - **Pregnancy. (Due to increase size of the uterus over the ureter causing obstruction of the ureter).**
 - **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 (common cause of it in young males is gonorrhoea).**
- Constitutional:
 - **Diabetes mellitus, Immunocompromised states**

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 (an elevated white blood cell count)
- Pyuria (Pus in the urine & it is more common in cystitis)
- Bacteriuria (bacteria in urine).

❖ In addition symptoms of lower tract involvement

- Dysuria (Painful or difficult urination)
- 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 (This group is often identified when short-course therapy for uncomplicated cystitis fails)
- In the extremes of age the presentation may be so atypical. (Extreme age means either infant or elderly).
- In the infant, the presentation may be feeding difficulty or fever.
- In the elderly presentation may be mental status change like confusion or fever. (sometimes elderly will show hypothermia).

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 bacteruria [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.

Radiological investigations

- CT scan
- IVP=intra venous pyelogram (X-ray test that provides pictures of the urinary tract)
- Radionucleotide imaging with gallium citrate 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:**
 - 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: (it is a sign of renal failure).

- 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

➤ With chronic pyelonephritis we usually have scarring so : **Progressive scarring** → renal failure



Assessment and diagnostic findings:

- IVP
- **Serum Creatinine** (high level of Creatinine indicate renal failure)
- **Blood urea.**
- **Culture and sensitivity.** (We have to sensitivity test because if the infection persists, it will lead to further kidney impairment).

Complications

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

Medical management

- **According to C&S result (urine culture and sensitivity)**
- **Drugs carefully titrated if renal function is impaired (decrease in drug dosage to a level that provides the optimal therapeutic effect with less renal damage).**

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:

- **Mild or moderate symptoms:**
 - ❖ **Outpatient treatment (total of 7–14 days)**

Oral treatment:

- Fluoroquinolone (ciprofloxacin)**
- 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.**

*In acute uncomplicated pyelonephritis we use only oral antibiotics.

*In hospitalized Pt, first we use I.V & then oral.

Summary:

- Pyelonephritis is Bacterial infection of the renal pelvis, tubules and interstitial tissue of one or both kidneys
- Pyelonephritis is a systemic infection and it's most common in females. (because of their short urethra).
- Infection usually ascends from the urethra in UTI infection
- Most of the bacteria come from the gut and the commonest cause of infection is E.Coli. on the other hand the commonest gram positive bacteria is enterococci, and S. saprophyticus cause the **Honeymoon cystitis**
- Some bacteria come from the blood (Hematogenous) like Staph.Aureus. Once you find it in urin you should look for accociated infection in other organs (like absces)
- Proteus mirabilis is non lactose forming organism & it breaks s down urea giving ammonia which makes the urine Alkaline
- The risk factors for having pyelonephritis in children is VUR, in elderly men is prostatic enlargement and in women is pregnancy
- You treat by history (**Pt. usually come with flank pain, Fever , Chills**) & examination & then you examine the urine looking for pus cells
- Blood culture is very important in the diagnosis of pyelonephritis , along with elevating of WBS
- Treatment from 10 to 14 days.