URINARY TRACT INFECTION

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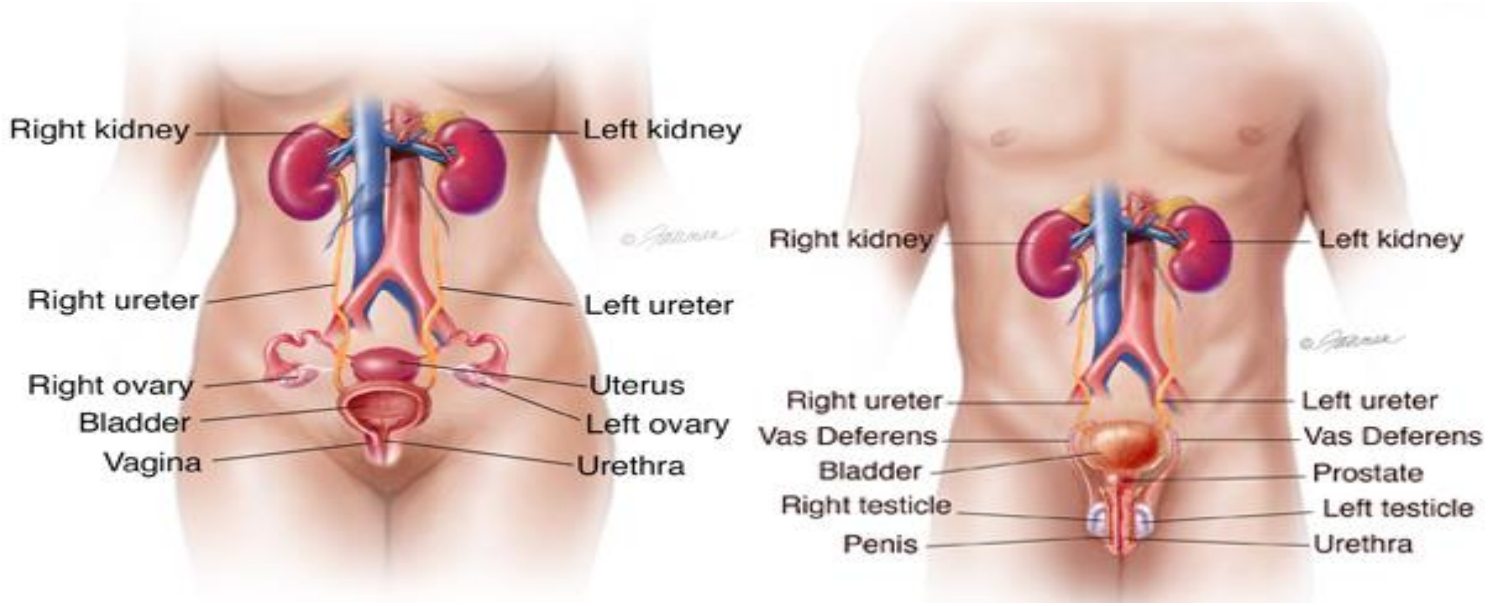


Urinary tract is normally sterile due to the fact that bacteria moving upwards are regularly washed out by urination

Normal flora found in the urethra consist of *lactobacillus and staphylococcus*

Background

1. Bacterial infections of urinary tract are a very common reason to seek health services
2. Common in young females and uncommon in males under age 50
3. Common causative organisms

- *Escherichia coli* (gram-negative enteral bacteria) causes most community acquired infections
- *Staphylococcus saprophyticus*, gram-positive organism causes 10 – 15%
- Catheter-associated UTI's caused by gram-negative bacteria: *Proteus*, *Klebsiella*, *Seratia*, *Pseudomonas*

URINARY TRACT INFECTION

- Second most common infection following respiratory infections
- 20% of women between ages 20-65 suffer one attack per year.
- Approximately 40% of women develop a UTI during their lives

TYPES

LOWER TRACT INFECTION

- URETHRITIS
- PROSTATITIS
- CYSTITIS

UPPER TRACT INFECTION

- PYELONEPHRITIS
- PERI NEPHRIC ABSCESS

UTIs are named according the place of infection

- -In the urethra = Urethritis
- -In the bladder = Cystitis
- -In the kidneys = Nephritis
- -In the prostate (men) = prostatitis

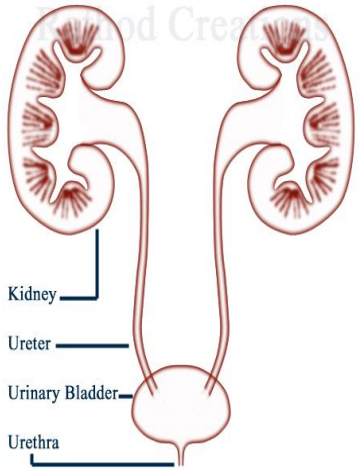
Majority of infections are caused by bacteria, though some are fungal

PATHOGENESIS

The normal bladder is capable of clearing itself of organisms within 2 to 3 days of their introduction.

Defense mechanisms

1. The elimination of bacteria by voiding
2. The antibacterial properties of urine and its constituents
3. The intrinsic mucosal bladder defense mechanisms
4. An acid vaginal environment (female)
5. Prostatic secretions (male)

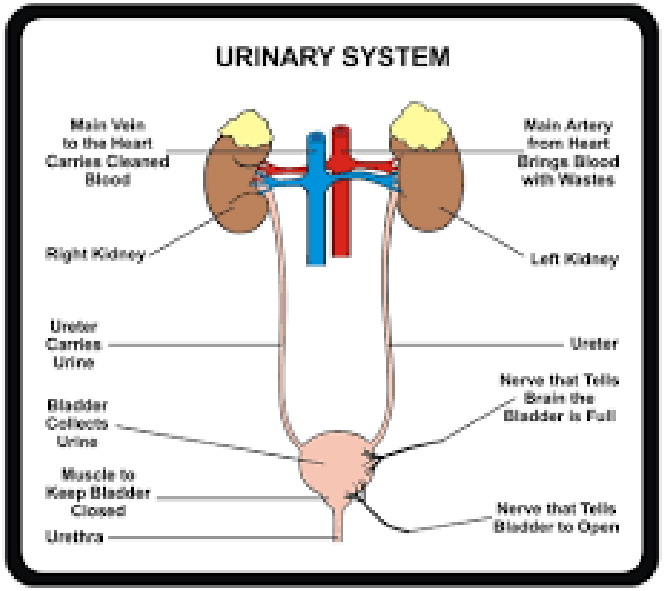


PATHOGENESIS

Two potential routes :

(1) The hematogenous route, with seeding of the kidney during the course of bacteremia

(2) The ascending route, from the urethra to the bladder, then from the bladder to the kidneys via the ureters.



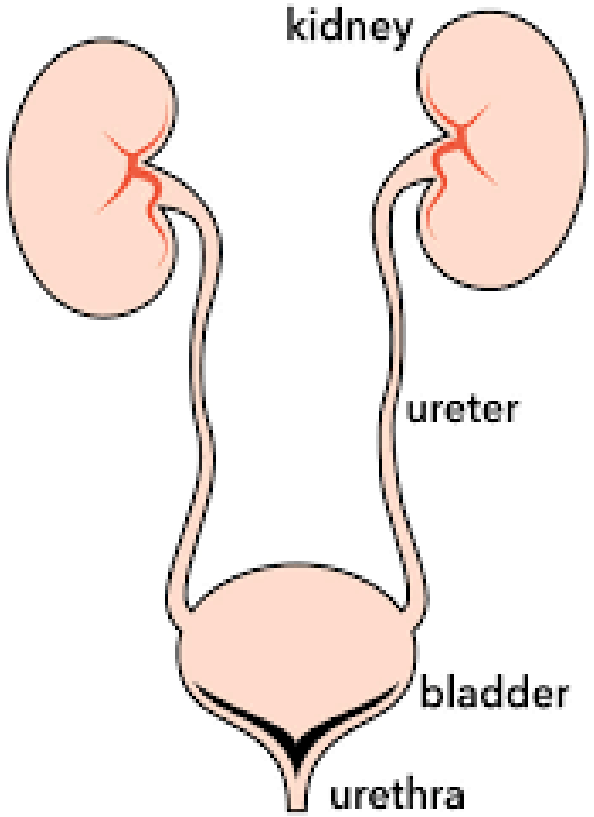
PATHOGENESIS

Hematogenous Infection

- Because the kidneys receive 20% to 25% of the cardiac output, any microorganism that reaches the bloodstream can be delivered to the kidneys.

- The major causes of hematogenous infection are *S. aureus*, *Salmonella* species, *P. aeruginosa*, and *Candida* species.

ASCENDING INFECTION



- UTI occur when bacteria (*E. coli*) from the digestive tract get into the opening of the urinary tract and multiply
- Bacteria first infect the urethra, then move to the bladder and finally to the kidneys
- UTI tend to occur more in women than men

Female are more prone to UTI

- Small urethra
- Gram negative organism radiate from perianal area to urethra
- Sexual intercourse
- Susceptibility of epithelium
- Pregnancy: ureteral tone and urethral peristalses decrease

Symptoms of UTI

- Dysuria
- Increased frequency, urgency
- Hematuria
- Fever
- Nausea/Vomiting (pyelonephritis)
- Flank pain (pyelonephritis)
- Discharge

Findings on Exam in UTI

- Physical Exam:
  - Suprapubic tenderness (**Cystitis**)
  - CVA tenderness (**pyelonephritis**)
  - Urethral discharge (**urethritis**)
  - Tender prostate on PRE (**prostatitis**)

lab

- Labs: Analyzing urine sample
  - + leukocyte esterase (dipstick test)
  - + nitrites
    - More likely gram-negative rods
  - + WBCs
  - + RBCs
- Gram stain of urine: identify by shape and characteristic (gram positive or negative); obtain by clean catch urine or catheterization
- Urine culture yielding greater than 100,000 colony-forming units (10^5 CFU) per ml = significant bacteriuria.

The specimen

- Mid-stream Urine (MSU) is the specimen of choice
- Suprapubic urine
- Catheter urine
- In all cases, urine must be examined immediately or stored at 4^{o}C
- Contamination of urine is a big problem!!

Culture: interpretation

- $>10^5$ cfu/ml of a single species strongly suggests a UTI
- 10^4-10^5/ml of a single species is equivocal – needs repeat specimen for testing
- $<10^4$/ml is regarded as no significant growth
- >1 species in any numbers suggests contamination

UTI

- Most common pathogen for **cystitis**, **prostatitis**, **pyelonephritis**:
  - *Escherichia coli*
  - *Staphylococcus saprophyticus*
  - *Proteus mirabilis*
  - *Klebsiella*
  - *Enterococcus*
- Most common pathogen for urethritis
    - *Chlamydia trachomatis*
    - *Neisseria Gonorrhea*

- Urease-producing members of the genus *Proteus* are associated with urinary stones, which themselves are predisposing factors for infection.
- A direct result of urease activity and ammonia generation is an increase in local pH.
- In the urinary tract alkaline pH leads to precipitation of calcium and magnesium ions and the formation of urinary stones composed of magnesium ammonium phosphate (struvite) and calcium phosphate (apatite).

Cystitis

1. Most common UTI
2. Remains superficial, involving bladder mucosa, which becomes hyperemic and may hemorrhage
3. General manifestations of cystitis
    - Dysuria
    - Frequency and urgency
    - Nocturia (excessive urination at night)
    - Urine has foul odor, cloudy (pyuria), bloody (hematuria)
    - Suprapubic pain and tenderness

Cystitis

- Uncomplicated (Simple) cystitis
  - In healthy woman, with no signs of systemic disease
- Complicated cystitis
  - In men, or woman with comorbid medical problems.
- Recurrent cystitis

Uncomplicated (simple) Cystitis

- Definition
  - Healthy adult woman (over age 12)
  - Non-pregnant
  - No fever, nausea, vomiting, flank pain
- Diagnosis
  - Dipstick urinalysis (no culture or lab tests needed)
- Treatment
  - Trimethroprim/Sulfamethoxazole for **3 days**
  - May use fluoroquinolone (ciprofoxacin or levofloxacin) in patient with sulfa allergy, areas with high rates of bactrim-resistance
- Risk factors:
  - Sexual intercourse
    - May recommend post-coital voiding or prophylactic antibiotic use.

Complicated

- Definition
  - Females with comorbid medical conditions
  - All male patients
  - Indwelling foley catheters
  - Urosepsis/hospitalization
- Diagnosis
  - Urinalysis, Urine culture
  - Further labs, if appropriate.
- Treatment
  - Fluoroquinolone (or other broad spectrum antibiotic)
  - **7-14 days** of treatment (depending on severity)
  - May treat even longer (2-4 weeks) in males with UTI

Special cases of Complicated cystitis

- Indwelling foley catheter
  - Try to get rid of foley if possible!
  - Only treat patient when symptomatic (fever, dysuria)
    - Leukocytes on urinalysis
    - Patient’s with indwelling catheters are frequently colonized with great deal of bacteria.
  - Should change foley before obtaining culture, if possible

Recurrent Cystitis

- Want to make sure urine culture and sensitivity obtained.
- May consider urologic work-up to evaluate for anatomical abnormality.
- Treat for 7-14 days.

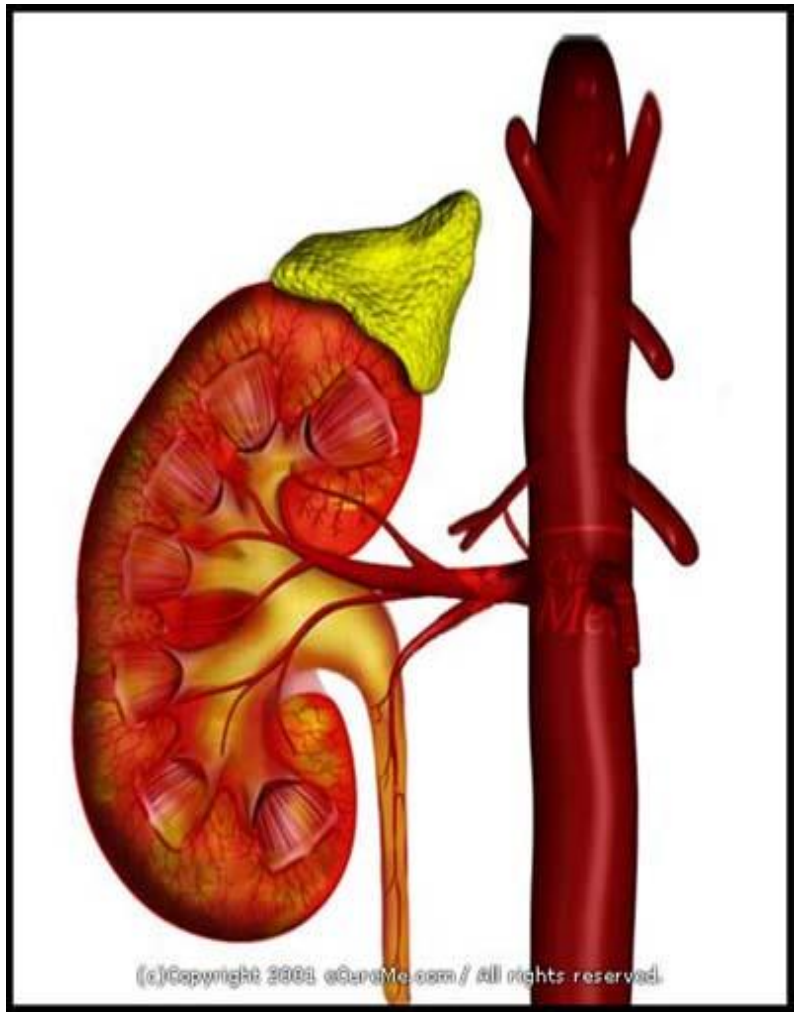
PYELONEPHRITIS

Pathophysiology

- Pyelonephritis, an upper urinary tract infection, is a bacterial infection of the renal pelvis, tubules, and interstitial tissue in one or both kidneys.
- Bacteria reach the bladder through the urethra and ascend to the kidney.
- It is frequently secondary to urine backup into the ureters usually at the time of voiding.
- Urinary tract obstruction (e.g. Urinary stones, tumors, and prostatic hypertrophy) is another cause.
- Pyelonephritis may be acute or chronic.

Etiology

- Almost always caused by E.coli
- Leading cause of gram negative sepsis and septic shock



Risk factors

- Pregnancy
- Urinary tract obstruction and congenital malformation
- Urinary tract trauma, scarring
- Renal calculi
- Polycystic or hypertensive renal disease
- Chronic diseases, i.e. diabetes mellitus
- Vesicourethral reflux

Clinical Manifestations

- Acute Pyelonephritis may be unilateral or bilateral, causing :
- Chills
- Fever,
- Flank pain
- Leukocyosis
- Bacteriuria .

Signs and Symptoms

- Pt will become acutely ill, weakness , malaise and pain in the costovertebral angle (CVA)
- CVA tenderness to percussion is a common finding

Costovertebral Angle (CVA)

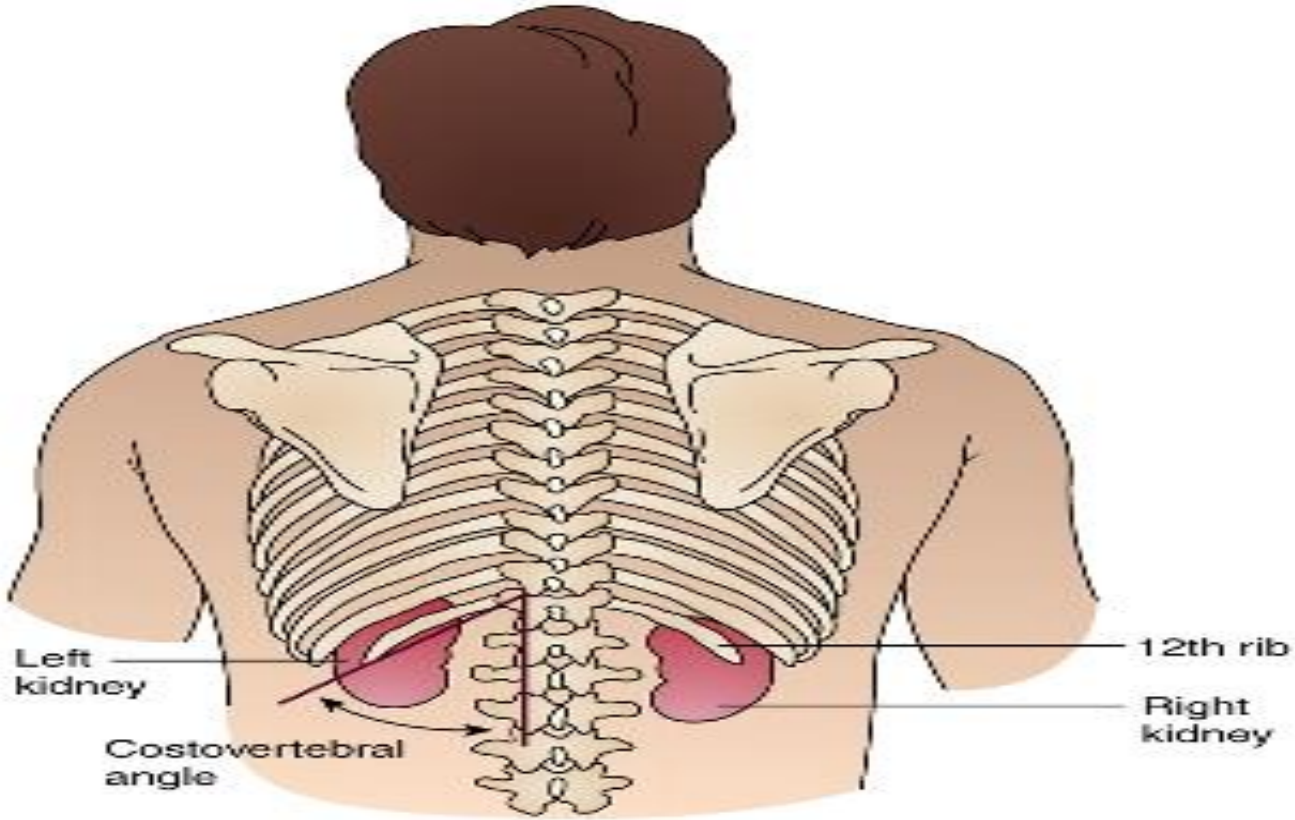


Figure 45-2 Location of the costovertebral angle.

Diagnostic Tests

- Diagnosis is confirmed by bacteria and pus in the urine and leukocytosis
- Urine analysis with culture and sensitivity identifies the pathogen and determines appropriate antimicrobial therapy

Diagnostic Tests

- CT with contrast, renal ultrasound, BUN and Creatine levels of the blood and urine may be used to monitor kidney function

Medical Management

- Goal of treatment is to eradicate bacteria from the urine.
- Pt will mild signs and symptoms may be treated on an outpatient basis with antibiotics for 14 to 21 days
- Antibiotics are selected according to results of urinalysis culture and sensitivity and may include broad-spectrum medications

Treatment of Pyelonephritis

- 2-weeks of Trimethroprim/sulfamethoxazole or fluoroquinolone
- Hospitalization and IV antibiotics if patient unable to take po.
- Complications:
  - Perinephric/Renal abscess:
    - Suspect in patient who is not improving on antibiotic therapy.

Medicines

- Ampicillin or vancomycin combined with an aminoglycoside (Nebcin, Garamycin) “Antibiotic”

- Cipro (ciprofloxacin “Antibiotic”

- (cotrimoxazole)

Septra Bactrim

“Trimethoprim”

Medical Management

- Adequate fluids at least eight glasses per day.
- Urinary analgesics such as Phenazopyridine (Pyridium) is helpful
- Follow up urine culture is indicated

Prostatitis

- Symptoms:
  - Pain in the perineum, lower abdomen, testicles, penis, and with ejaculation, bladder irritation, bladder outlet obstruction, and sometimes blood in the semen
- Diagnosis:
  - Typical clinical history (fevers, chills, dysuria, malaise, myalgias, pelvic/perineal pain, cloudy urine)
  - The finding of an edematous and tender prostate on physical examination
  - Will have an increased PSA
  - Urinalysis, urine culture

Prostatitis

- Risk Factors:
  - Trauma
  - Sexual abstinence
  - Dehydration
- Treatment:
  - Trimethoprim/sulfamethoxazole, fluroquinolone or other broad spectrum antibiotic
  - **4-6 weeks of treatment**