CHAPTER: 1
URINARY TRACT INFECTION

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Urinary tract infection (UTI) :

Is an infection that affects any part of the urinary tract.

• Mostly Bacterial.
• UTIs can involve
  • the urethra
  • prostate
  • bladder
  • kidneys.
SYMPTOMS AND SIGNS

• Symptoms may be absent or include
  • urinary frequency and urgency,
  • dysuria,
  • lower abdominal pain,
  • and flank pain.

• Systemic symptoms and even sepsis may occur with kidney infection.
ETIOLOGY

- About 95% of UTIs occur when bacteria ascend the urethra to the bladder and, in the case of acute uncomplicated pyelonephritis, ascend the ureter to the kidney.

- The remainder of UTIs are hematogenous.

- The most common causes of UTI infections (about 80%) are *Escherichia coli*.

- Many other bacteria can occasionally cause an infection - for example:
  - *Klebsiella*
  - *Enterobacter*
  - *Staphylococcus*
  - *Mycoplasma*
  - *Chlamydia*
  - *Serratia*
• In fungi (*Candida* and *Cryptococcus* spp), viruses and some parasites (*Trichomonas, Schistosoma*) also may cause UTIs.

• For less frequent than E. Coli.
PATHOGENESIS

- Colonization
- Migration
- Attachment.
PATHOPHYSIOLOGY

TWO POTENTIAL ROUTES:

(1) THE HEMATOGENOUS ROUTE:

- 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*
  - *Candida species.*
THE ASCENDING ROUTE:

- From the urethra to the bladder, then from the bladder to the kidneys via the ureters.

- Implicated pathogens mostly include:
  - *E. coli*
  - *P. mirabilis*
  - *K. pneumoniae*.

- Others: E.Cloacae, Serratia, P.aeruginosa.
• COMPLICATED UTI is considered to be present when there are underlying factors that predispose to ascending bacterial infection.  
  • urinary instrumentation  
  • anatomic abnormalities  
  • and obstruction of urine flow.

• UN COMPLICATED UTI occurs without underlying abnormality or impairment of urine flow.  
  • most common in young women.  
  • Risk factors in women include sexual intercourse, diaphragm and spermicide use, antibiotic use, and a history of recurrent UTIs.
ETIOLOGY OF UNCOMPLICATED UTIS IN THE US (WOMEN 15–50 YEARS OLD)

GRAM - NEGATIVES:
- *Escherichia coli* (72%)
- *Klebsiella* species (6%)
- *Proteus* species (4%)
- Other (5%)

GRAM - POSITIVES:
- *Enterococcus* species (5%)
- Other Gram-positive organisms (7%)
COMPLICATED UTI

- Most common UTI in men aged 16–35 years.
- Most common nosocomial infection.
- 31% of hospital-acquired infections.

Complicated UTI Etiology

<table>
<thead>
<tr>
<th>Bacterial Uropathogen</th>
<th>Prevalence in Complicated UTI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Escherichia coli</em></td>
<td>21 – 54</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>1.9 – 17</td>
</tr>
<tr>
<td>Enterobacter species</td>
<td>1.9 – 9.6</td>
</tr>
<tr>
<td>Citrobacter species</td>
<td>4.7 – 6.1</td>
</tr>
<tr>
<td><em>Proteus mirabilis</em></td>
<td>0.9 – 9.6</td>
</tr>
<tr>
<td>Providencia species</td>
<td>18</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>2 – 19</td>
</tr>
<tr>
<td>Enterococci species</td>
<td>6.1 – 23</td>
</tr>
</tbody>
</table>
CLASSIFICATION

UPPER

• Pyelonephritis.

LOWER

• Cystitis (most common)
• Asymptomatic bacteriuria
• Urethral syndrome
• Others.
Differential Diagnosis of Bacteriuria

Patient Symptomatic? no → Asymptomatic bacteriuria

yes → Complicating Factors?

yes → Complicated UTI

no → Recurrent Episode?

yes → Recurrent UTI

no → Upper Tract Symptoms?

yes → Pyelonephritis

no → Uncomplicated cystitis, urethritis, or vaginitis
URETHRITIS

- Inflammation of the urethra.
- Highly associated with **sexual activity**

<table>
<thead>
<tr>
<th>GONOCOCCAL URETHRITIS</th>
<th>NON – GONOCOCCAL URETHRITIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neisseria gonorrhoeae</td>
<td>Chlamydia trachomatis</td>
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<tr>
<td></td>
<td>Adenovirus</td>
</tr>
<tr>
<td></td>
<td>Uropathogenic</td>
</tr>
<tr>
<td></td>
<td><em>Escherichia coli</em> (UPEC)</td>
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<tr>
<td></td>
<td>Herpes simplex</td>
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<td></td>
<td><em>Mycoplasma genitalium</em></td>
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<td></td>
<td>Reiter's syndrome</td>
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<tr>
<td></td>
<td><em>Trichomonas spp.</em></td>
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<tr>
<td></td>
<td>Ureaplasma urealyticum</td>
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</tbody>
</table>
SYMPTOMS AND TREATMENT

• Dysuria, painful micturition.

• In men, purulent discharge usually indicates a urethritis of gonococcal nature, while clear discharge indicates urethritis of non-gonococcal nature.

• In women up to 80% of infections are with few symptoms or are asymptomatic.

• Treatment:
  • Ceftriaxone - Gonorrhea
  • Fluconazole - Monilial
  • Metronidazole (Flagyl) - Trichomonial
  • Co-trimoxazole
  • Tetracyclines
CYSTITIS

- Inflammation of the bladder.

- Most common UTI.

- Community acquired or nosocomial.

- Causes may be:
  - Bacterial
  - Viral
  - Fungal
  - Parasitic
BACTERIAL CYSTITIS

- Most common.

- The most common organism implicated in UTIs

  - *E. coli* (80–85)%.

  - *Staphylococcus saprophyticus* is the cause in (5–10)%.

  - Others contribute the remainder.
    - *Enterobacter cloacae*
    - *Klebsiella pneumoniae*
    - *Serratia marcescens*
    - *Proteus mirabilis*
    - *Pseudomonas aeruginosa*
VIRAL CYSTITIS

- Adenoviruses

- Severe bladder irritation, sometimes hemorrhagic.

- Treatment: Usually Self Limited
  (anti-inflammatory medications and hydration).
FUNGAL CYSTITIS

• In immunocompromised and with prolonged hospitalization.

• Mostly due to: Candida and aspergillus.

• Diagnosis: special cultures.

• Treatment: Amphotericin, ketoconazole.
TREATMENT

- Pyelonephritis is a dangerous infection and must be treated promptly.
  - Rest.
  - Drinking large amount of water.
  - Antibiotics: 10-14 days until symptom free.
  - Treat related diseases: diabetes, renal stones, vaginal infection, etc.
ANTIMICROBIAL THERAPY

• THREE GOALS:
  • Control or prevention of the development of urosepsis.
  • Eradication of the invading organism.
  • Prevention if recurrences.

• MEDICATIONS:
  • Trimethoprim-sulfamethoxazole.
  • Fluoroquinolones.
  • Ampicillin, amoxicillin, first-generation cephalosporins.