UTI 1+2

- **Definition**: Infection in any part of the urinary system (*urethra, bladder, ureters, kidneys*).
- **Key Fact**: **Most common outpatient infection**.

- **Risk Groups**:
  - **Sexually active women** (↑ risk of *S. saprophyticus*).
  - **Postmenopausal women** (↓ estrogen → ↓ vaginal lactobacilli → ↑ *E. coli* colonization).
  - **Pregnant women** (hormonal changes → urinary stasis → ↑ UTI risk).
  - **Uncircumcised male infants**.
  - **Immunocompromised** (viral/fungal UTIs).

Category	Key Mechanisms
Anatomical	Unidirectional urine flow, ureterovesical junction (prevents reflux), epithelial cell turnover (sloughs infected cells).
Physiological	Acidic pH, high osmolality, urea concentration → hostile to bacteria.
Immunological	**Antimicrobial peptides** (urothelial cells), **mucus barrier**, secretory IgA (blocks pathogen adhesion).
Behavioral	Frequent urination → reduces bacterial load.

Pathogenesis

1. **Ascending Infection (95%)**:
   - Fecal flora → periurethral colonization → urethra → bladder → kidneys **(*E. coli* most common).**
   - If kidneys infected → **pyelonephritis**.
2. **Hematogenous (Rare)**:
   - Bloodstream → kidneys (in immunocompromised).
   - Pathogens: *S. aureus, Salmonella, Candida*

Pathogens (Memorize!)

Pathogen	Features	Clinical Association
E. coli (UPEC)	Gram(-), lactose fermenter. Virulence: **Type 1 fimbriae** (adhesion), **P fimbriae** (pyelonephritis).	**80% of uncomplicated UTIs. 1st MC**
S. saprophyticus	Gram(+), coccus, **novobiocin-resistant**. **while** S.epidermidis **sensitive to novobiocin .**	**Young, sexually active women (2nd most common).**
Klebsiella pneumoniae	Gram(-), rod ,encapsulated, lactose fermenter, encapsulated .	**3rd most common; hospital-associated.**
Proteus mirabilis	Gram(-), **urease(+)**, swarming motility. ↑ pH → **struvite stones mgAgpo4 ,apatite** Capo4	Complicated UTIs, catheter-associated.
Enterococcus faecalis	Gram(+) cocci in chains.	Hospital-acquired, catheterization ,instrumentation. Large intestin
Candida spp.	Fungi.	Immunocompromised, catheterized patients.

Predisposing Factors

- **Host-Dependent**:
    - **Female anatomy** (short urethra, proximity to anus).
    - **Structural abnormalities**: BPH, vesicoureteral reflux, neurogenic bladder, stones → urinary stasis.
    - **Pregnancy/postmenopause** (hormonal changes).
- **Other Factors**:
    - **Postcoital cystitis** ("honeymoon cystitis").
    - **Catheter-associated UTIs**.
    - Chronic constipation.

Classification

1. **By Symptoms**:
    - **Asymptomatic bacteriuria (ASB)**: ≥100,000 CFU/mL in 2 samples *without symptoms*.
    - **Symptomatic UTI**: Bacteriuria + symptoms.
2. **By Location**:
    - **Lower UTI**: Cystitis (bladder)MC , urethritis, prostatitis (men).
    - **Upper UTI**: Pyelonephritis (kidneys).
3. **By Complexity**:
    - **Uncomplicated**: Healthy nonpregnant women, no risk factors.
    - **Complicated**: Males, pregnancy, diabetes, immunosuppression, stones, catheters.
4. **Recurrent UTI**: ≥3 episodes/year or ≥2 in 6 months.

. Clinical Features

- **Lower UTI (Cystitis)**:
    - Dysuria, frequency, urgency, suprapubic pain, cloudy/foul urine, **microscopic hematuria**.
- **Upper UTI (Pyelonephritis)**:
    - **Fever, chills, flank pain, CVA tenderness**, nausea/vomiting.
- **Special Groups**:
    - **Older adults**: Delirium الهذيان(often only symptom!).
    - **Children**: Irritability, malodorous urine, new incontinence.
    - **Men**: Prostatic/perineal pain.

Diagnostics

Urinalysis (Best Initial Test)

- **Collection**: Clean-catch midstream urine (minimize contamination).
- **Key Findings**:
  - **Positive nitrites**: Gram(-) bacteria (e.g., *E. coli*).
  - **Positive leukocyte esterase:** enzyme by WBCs
  - **Pyuria** (WBCs in urine).
  - **Bacteriuria**: Bacteria on microscopy.
  - **WBC casts**: Indicative of **pyelonephritis**.
  - Hematuria (micro/macroscopic).

Urine Culture (Indications)

- Suspected pyelonephritis, complicated UTI, treatment failure, recurrent UTIs.
- **Thresholds for Positivity**:
  - $\geq 10^5$ CFU/mL (clean-catch).
  - *Any growth* (suprapubic aspiration).
- **Pathogen Identification**:
  - *E. coli*: Pink colonies (MacConkey agar).
  - *K. pneumoniae*: Mucoid viscous colonies.
  - *P. mirabilis*: Swarming motility.
  - *P.aeruginosa* :blue-green pigment

Diagnostic Approach

- **Uncomplicated lower UTI (women)**: Treat empirically if classic symptoms. Nitrofurantoin, Trimethoprim-sulfamethoxazole
- **Atypical symptoms/complicated UTI**: Urinalysis + culture *mandatory*.---outpatient: oral ciprofloxacin or levofloxacin or ---inpatient :IV ceftriaxone
- **Asymptomatic** : doesn't need treatment except (pregnant , recent kidney transplant)

Prevention & Complications

- **Prevention**: Hydration, postcoital voiding, front-to-back wiping, topical estrogen (postmenopausal).
- **Complications**:
  - Pyelonephritis → **perinephric abscess, urosepsis, renal scarring**.
  - Pregnancy: **Preterm labor**.

Case-Based Pearls (From Lecture Quizzes)

- **Recurrent UTI in young woman**: Likely due to **urethral colonization** -- retrograde urine flow
- **Pyelonephritis Indicator**: **WBC casts**
- **Nitrite(+) & LE(+) Urinalysis**: Most likely **E. coli**