Urinary Tract Infections part (2)

Urogenital Tract Module

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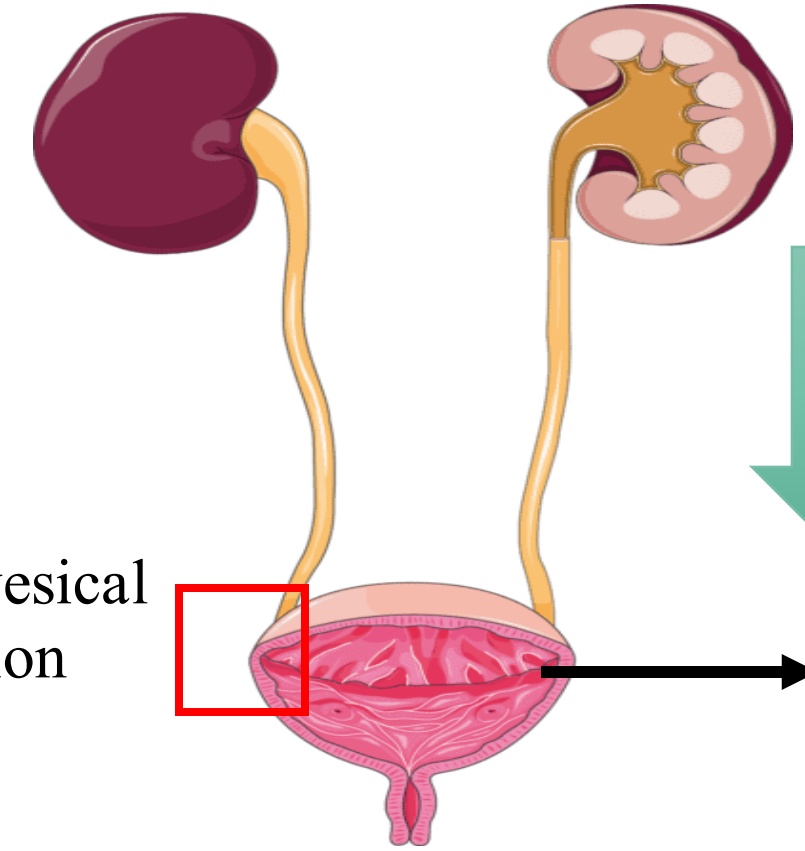
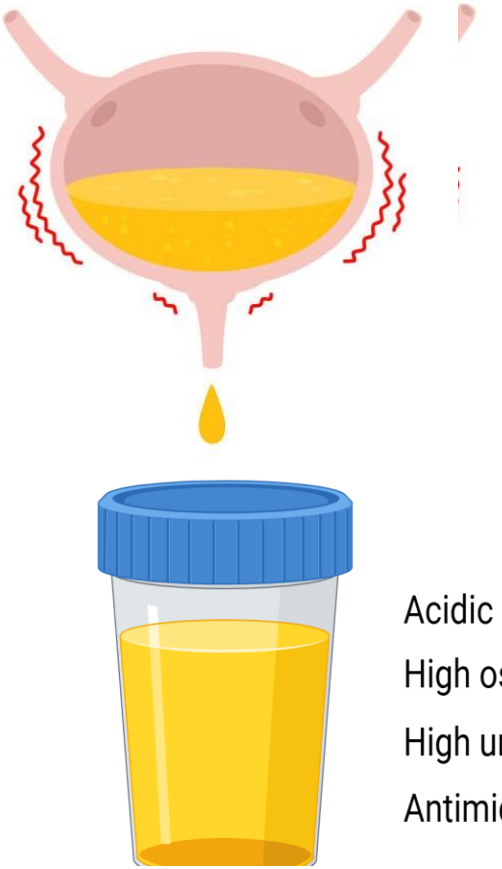
Urinary Tract Defences



Unidirectional urine flow

Ureterovesical junction

Epithelial cell turnover



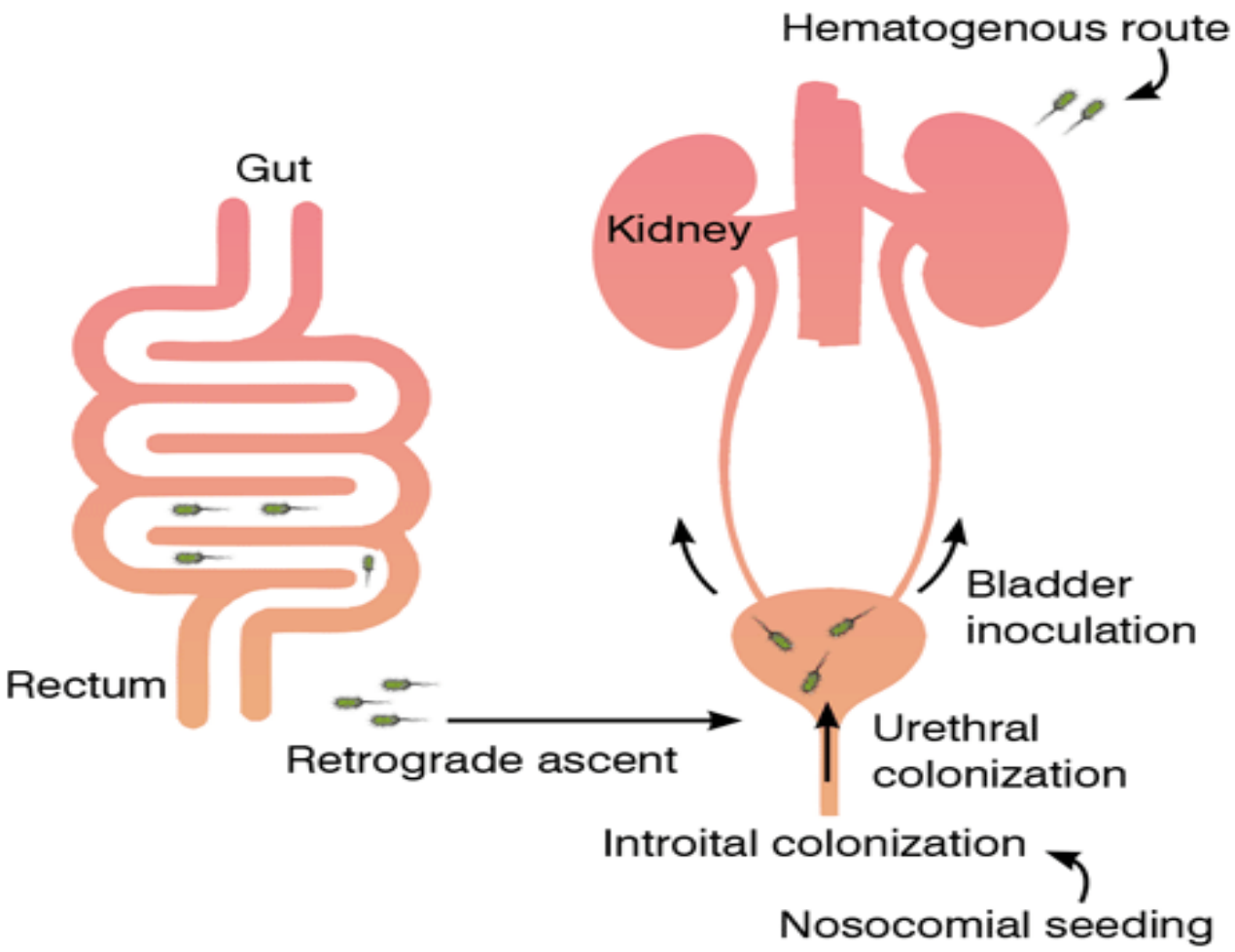
Acidic PH

High osmolality

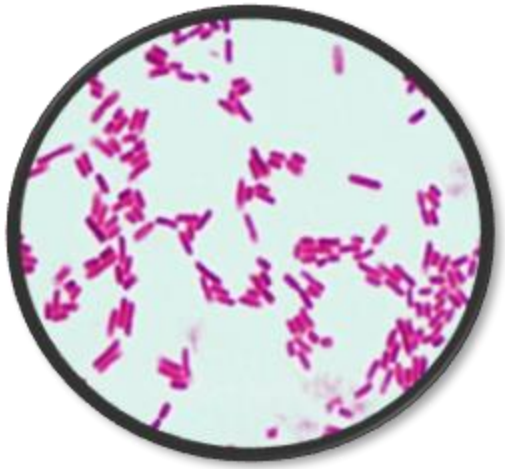
High urea concentration

Antimicrobial peptides

Pathophysiology



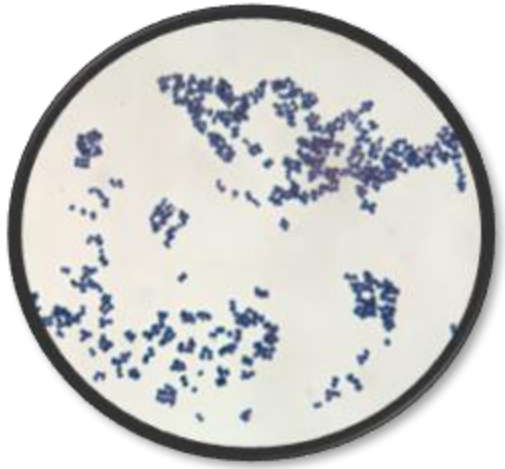
Etiology- Pathogens



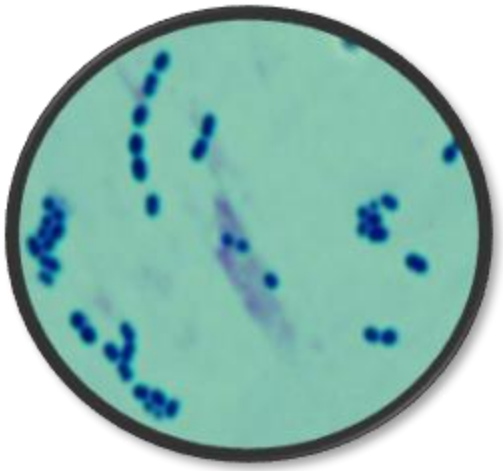
E. coli

K. pneumoniae

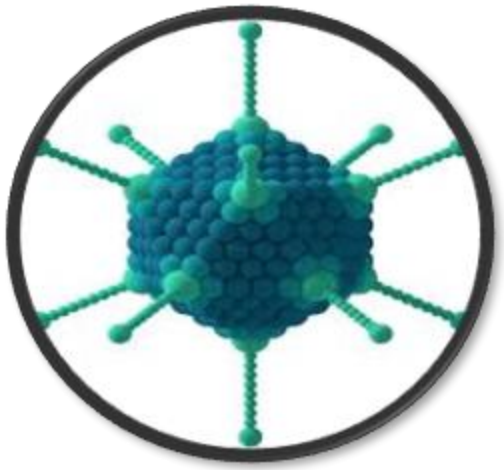
P. mirabilis



S. saprophyticus



E. faecalis



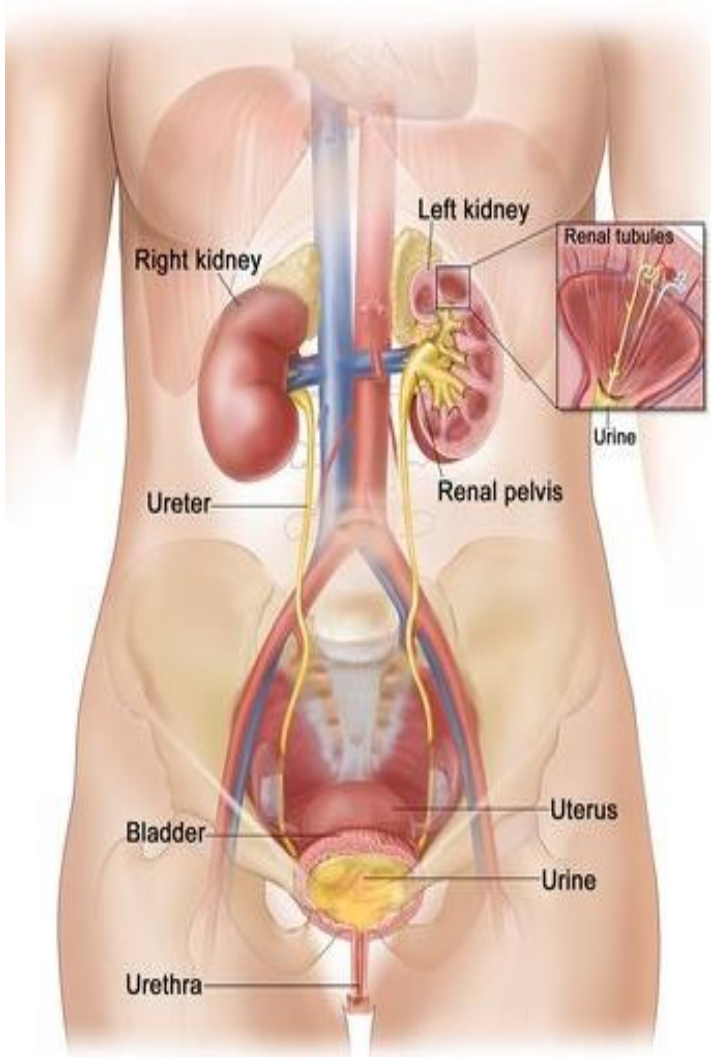
Viruses

Fungi

Etiology- Predisposing Factors

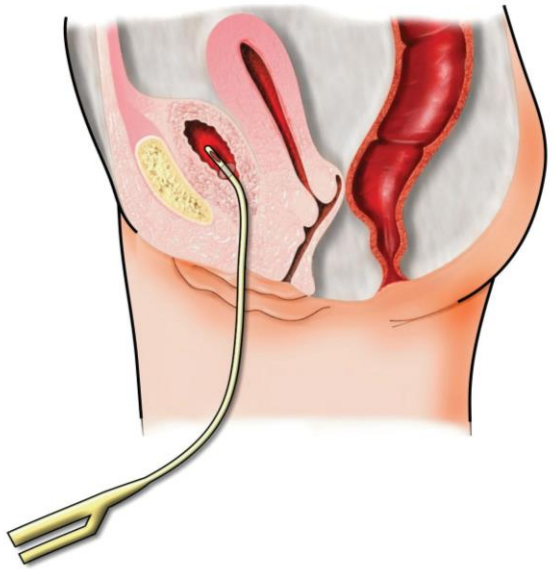
Host-dependent factors

- Gender
- Pregnancy
- Post menopause
- Obstruction
- Structural or functional abnormalities of the urinary tract



Other factors

- Postcoital cystitis
- Catheter-associated UTI



to be continued...

Urinary Tract Infections part (2)

Outlines

- UTI classification
- Clinical presentation
- Diagnosis
- Treatment
- Complication and prevention

Classification

- Urinary tract infections are classified and treated based on presentation, location, severity, and frequency.

Classification

By clinical presentation

Asymptomatic bacteriuria (ASB)

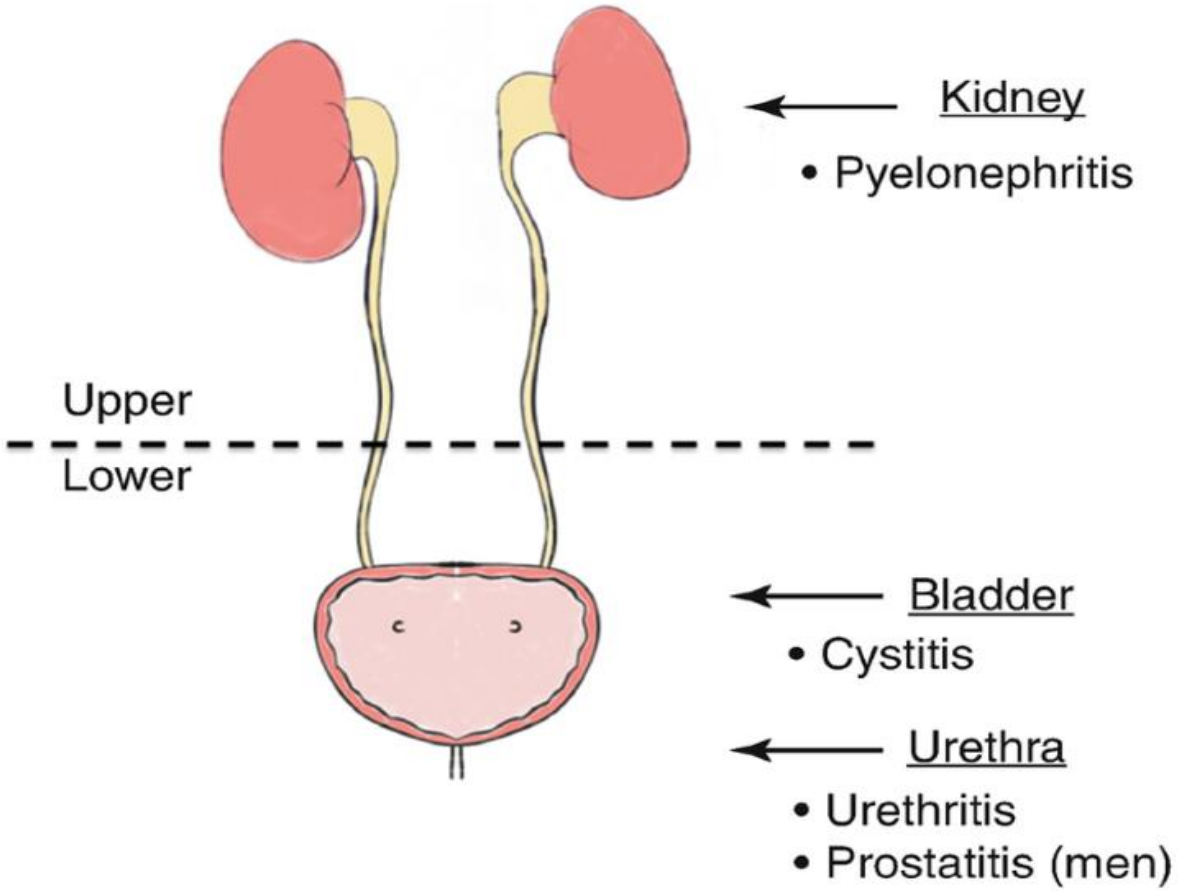
defined by the presence of **≥ 100,000 CFU/mL** in at least two voided urine samples in patients with **no symptoms** of UTI

Urinary tract infection (UTI)

Bacteriuria and clinical features of UTI

Classification

By location



Classification

By location

Lower UTI

- Infection of the bladder (**cystitis**), the most common location of UTIs
- Often accompanied by **urethritis**
- Can be associated with **prostatitis** in men

Upper UTI

- Infection of the kidneys and ureter (**pyelonephritis**)

Classification

By frequency

Recurrent UTI

≥ 3 episodes of symptomatic, culture-proven UTI

in one year or **≥ 2 episodes in 6 months**

Classification

By severity	**Uncomplicated UTI**	Infection in nonpregnant, premenopausal women without further risk factors for infection, treatment failure, or serious outcomes

	Complicated UTI	• Infection in patients with risk factors for infection, treatment failure, or serious outcomes, including:
		  • Male
		  • Pregnancy, Post menopause
		  • Significant anatomical or functional abnormalities
		  • Immunosuppression, Renal failure
		  • Metabolic disorders (e.g., diabetes)
		• Infection associated with recent instrumentation or medical devices.
		• Healthcare-associated UTIs

Clinical Features- Cystitis

- **Cystitis:** inflammation of the bladder
- Patients with cystitis usually report dysuria, frequency, urgency, and suprapubic pain.
- The urine often becomes **grossly cloudy** and malodorous and is bloody in ~30% of cases.
- Physical examination generally reveals only tenderness of the urethra or the suprapubic area.
- If a **genital lesion or a vaginal discharge** is evident, then pathogens that may cause urethritis, vaginitis, or cervicitis (e.g., *C. trachomatis*, *N. gonorrhoeae*, and HSV) should be considered.

Clinical Features- Urethritis

- Urethritis → inflammation of the urethra
- Clinically, cannot always be readily distinguished from those with cystitis.
- In this situation, a distinction from women infected with **sexually transmitted pathogens** (e.g., *C. trachomatis, N. gonorrhoeae*, or HSV) should be made:
  - Chlamydial or gonococcal infection should be suspected in women with a gradual onset of illness, no haematuria, no suprapubic pain, and >7 days of symptoms.
  - The additional history of a recent sex-partner change, especially if the partner has recently had chlamydial or gonococcal urethritis, should heighten the suspicion of a sexually transmitted infection,

Clinical Presentation- Lower UTI

Painful urination or dysuria

Increased urinary frequency

Suprapubic tenderness

Cloudy or foul-smelling urine

Haematuria

Clinical Features- Acute Pyelonephritis

- Acute Pyelonephritis →bacterial infection of the kidney
- Symptoms generally develop rapidly over a few hours or a day and include **fever**, shaking chills, **nausea, vomiting**, **abdominal pain**, and **diarrhoea**, **fatigue**.
- **Symptoms of cystitis** are sometimes present.
- Physical examination generally reveals marked tenderness on deep pressure in one or both **costovertebral angles**.
- **Leukocyte casts** are present in the urine of some patients, and the detection of these **casts is pathognomonic**.

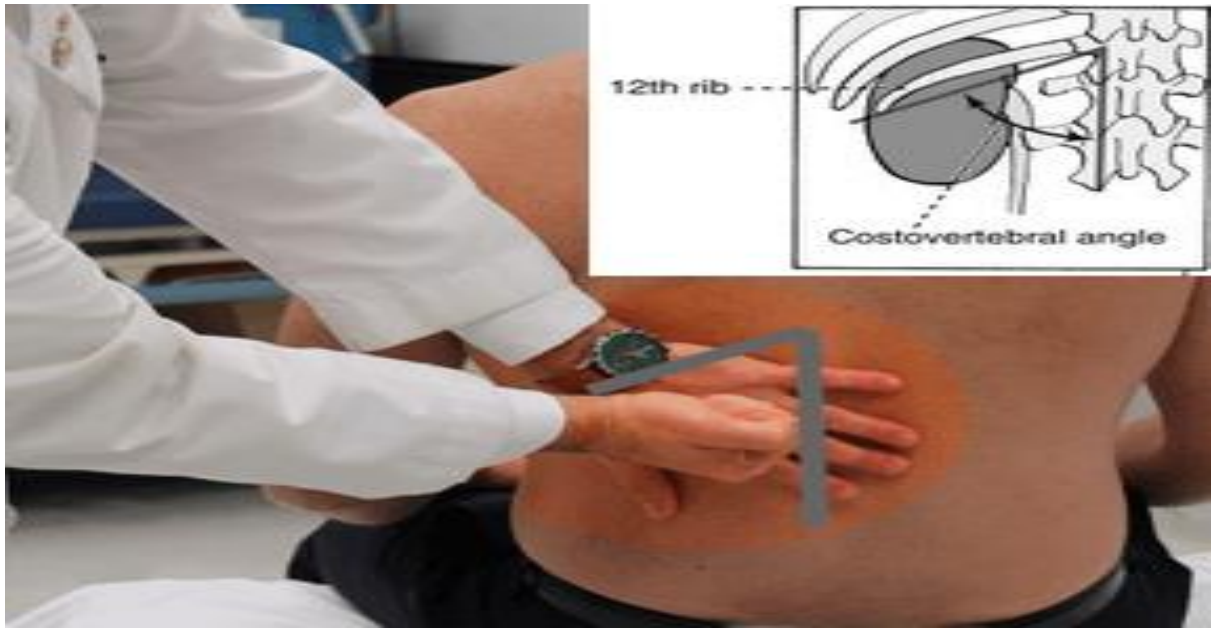
Clinical Presentation- Upper UTI

Fever

Nausea and vomiting

Flank pain

Fatigue



Costovertebral angle tenderness: Pain that is elicited upon percussion of the costovertebral angle (approx. 12th rib).
When present, this finding should raise concern for pyelonephritis.

Clinical Presentation- Symptoms in special patient groups

- Male individuals: pain in the prostatic/perineal area
- Children: Caregivers may report the following in young children: new-onset urinary incontinence (if toilet trained), irritability, crying when urinating, poor feeding, malodorous urine.
- Older adults: delirium/acute confusion

Diagnostics- Approach

Uncomplicated lower UTI in women

Typical symptoms

Treatment may be initiated without further diagnostics

Atypical or unclear symptoms

Perform urinalysis

+ Initiate treatment

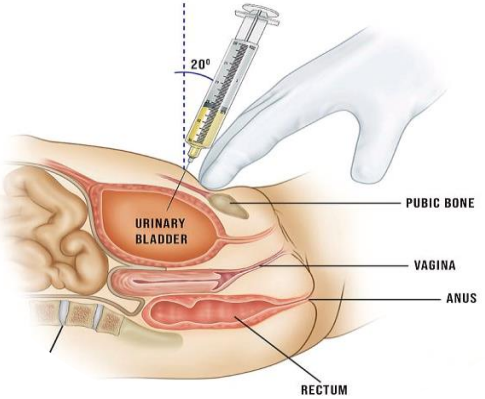
− Obtain urine culture

- Lower UTI in men
- Suspected upper tract infections
- Complicated UTI in women

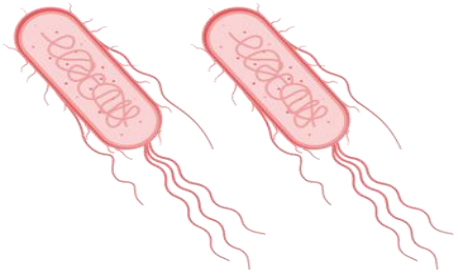
- Obtain urinalysis and urine culture
- Consider concomitant prostatitis

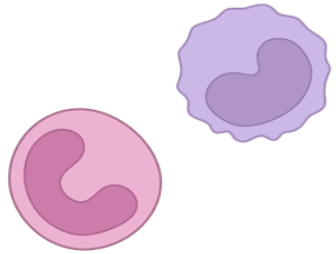
Diagnostics- Urinalysis

- Best initial test for all patients
- Procedure: visual, chemical (dipstick), and microscopic examination of urine
- Specimen collection method:
  - Clean-catch **midstream** sample → reduce contamination with vaginal or skin flora.
  - Straight catheterization of the bladder → if the risk of contamination is high.
  - Suprapubic aspiration → no contamination if performed correctly. Rarely used due to its invasive nature.



Diagnostics- Urinalysis Findings

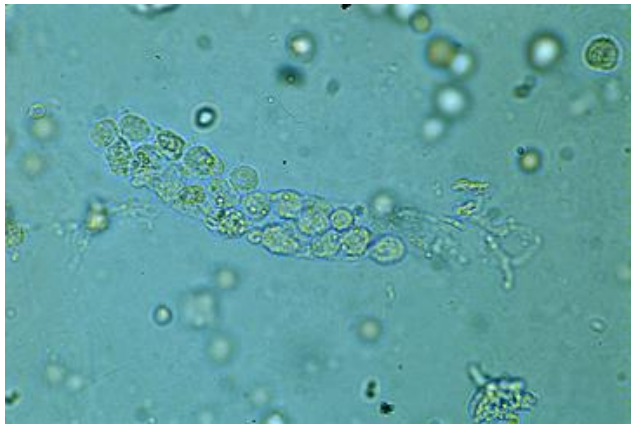




- Bacteriuria: presence of bacteria in the urine.
- Direct visualization by Gram stain (rarely performed)
- Positive urinary nitrites: indicate bacteria that convert nitrates to nitrites (commonly **gram-negative bacteria**)

- Pyuria: presence of white blood cells (WBCs) in the urine.
- Leukocyte casts rare finding → a strong indicator for pyelonephritis.
- Positive leukocyte esterase: an enzyme produced by WBC
- Micro- or macroscopic haematuria.

Diagnostics- Urinalysis Findings



- White Blood Cell casts are cylindrical structures composed of leukocytes (usually neutrophils) embedded in a protein matrix that forms in the **renal tubules**.

Diagnostics- Urine Culture

- **Indications:** Suspicion for complicated UTI, healthcare-associated UTI, or pyelonephritis.
- **Interpretation**: Cultures are considered positive if:
  - Significant bacteriuria: defined as **≥ 10^5 CFU/mL** in a clean-catch specimen
  - Any organisms in a specimen obtained by suprapubic aspiration
- Typical colony findings:
  - *E. coli*: intensely pink on MacConkey agar
  - *K. pneumoniae*: pink on MacConkey agar
  - *P. mirabilis*: swarming motility pattern
  - *P. aeruginosa*: blue-green pigment

K. pneumonia

P. aeruginosa

Diagnostics- Imaging

- Imaging is generally not indicated for the diagnosis of lower UTI.
- Indications may include:
  - Suspected urinary tract obstruction
  - Recurrent complicated UTI
  - Men with febrile UTI

Diagnostics- Imaging

- CT scan:
  - CT abdomen and pelvis with or without IV contrast is considered most **sensitive for initial imaging**.
  - Findings supportive of urinary tract obstruction → Hydroureter, hydronephrosis, Nephrolithiasis, urolithiasis
- Ultrasound of the kidneys and bladder
  - Perform if there are contraindications to contrast or radiation.
- Additional modalities include MRI abdomen and pelvis, voiding cystourethrography.

Treatment

- **Uncomplicated UTI** (simple cystitis): Nitrofurantoin or Trimethoprim-sulfamethoxazole for 3 days
- **Complicated UTI** (including pyelonephritis)
  - Outpatient: 7- to 14-day course oral ciprofloxacin or levofloxacin
  - Inpatient options: IV ceftriaxone
- **Supportive treatment:** Oral analgesia, e.g., with NSAIDs, can provide additional relief.
- **Asymptomatic bacteriuria:** usually do not require treatment, unless: pregnant or recent kidney transplant

Treatment- General principles

- Persistent symptoms despite antibiotic therapy suggest complicated UTI and/or indicate the need to change the empiric therapy.
- Relieve obstruction, if present:
  - Foley catheter for bladder outlet obstruction (i.e., BPH)
  - Urologic intervention for nephrolithiasis, ureteral obstruction, or perinephric abscess

Prevention

- Increase oral fluid intake
- Timely bladder voiding
- Post-coital voiding
- Adequate genital hygiene
- Minimize faecal contamination by wiping front to back.
- Topical oestrogen in post-menopausal women (promotes healthy vaginal flora)

Complications

In general

- Perinephric abscess
- Urosepsis
- Emphysematous pyelonephritis
- Atrophic kidneys
- End-stage renal disease (ESRD)

In male individuals

- Urethral stricture
- Epididymitis
- Prostatitis
- Orchitis

In pregnant women

- Increased risk of preterm labour and birth

- A 21-year-old woman comes to the office for evaluation of urinary frequency and urgency for the past 2 days. She has also noticed scant vaginal discharge. The patient has never had these symptoms before. She has no chronic medical conditions. A urine sample is obtained for urinalysis and culture. Which of the following additional findings would be most suggestive of a diagnosis of pyelonephritis?

A. Bacteriuria
B. Fever
C. Leucocytosis
D. Microscopic haematuria
E. Sterile pyuria
F. White blood cell casts ✓

- A 24-year-old man comes to the office due to 2 days of burning pain with urination. The patient has also had increased urinary frequency over the past few days. He has had no fever, chills, nausea, vomiting, flank pain, or penile discharge. The patient is sexually active with his longtime girlfriend. Vital signs are within normal limits. Physical examination shows mild suprapubic tenderness. There is no costovertebral angle tenderness. The penis is uncircumcised.

Laboratory results are as follows:

Urinalysis

pH: 5
Blood: negative
Leukocyte esterase: positive
Nitrites: positive

- Based on the urinalysis results, which of the following organisms is the most likely cause of this patient's illness?

A. *Candida albicans*

B. *Enterococcus faecalis*

C. *Escherichia coli*

D. Herpes simplex virus

E. *Proteus mirabilis*

F. *Staphylococcus saprophyticus*

Thank you