



# Cystitis

## Renal Block

*Dr. Khalifa Binkhamis & PROF.HANAN HABIB*

*Department of Pathology, Microbiology Unit*



# Objectives

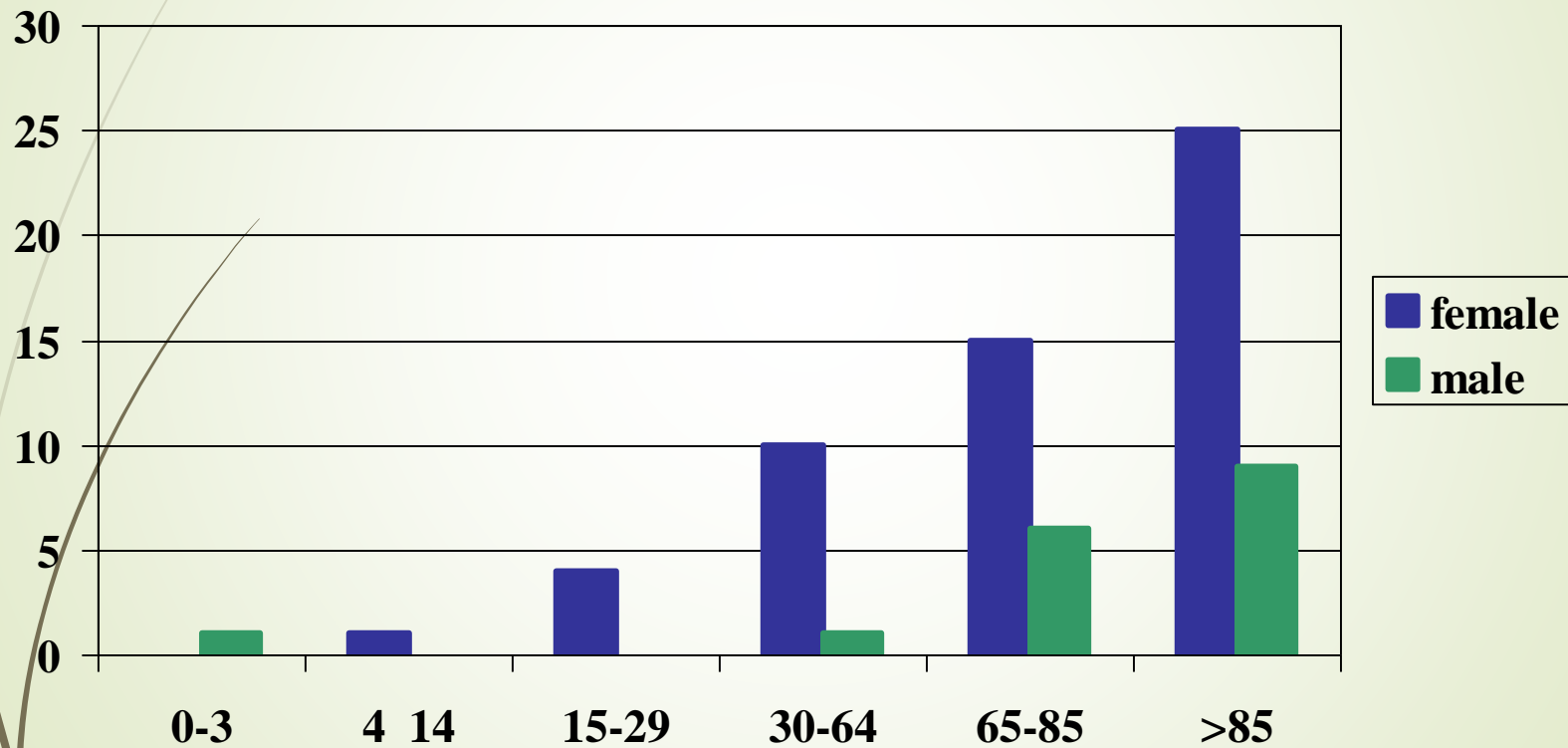
- 1- Define the term cystitis and recall who commonly gets cystitis.
- 2- Describe the pathogenesis and risk factors of cystitis.
- 3- List the most common causative organisms of cystitis
- 4- Recall the different types of cystitis (infectious and non-infectious).
- 5- Describe the clinical presentation of cystitis
- 6- Describe the laboratory diagnosis of cystitis
- 7- Recall the antimicrobial agents suitable for the treatment and prevention of cystitis.



# Introduction

- Urinary Tract infection (UTI) divided into upper and lower urinary tract infections
- Patient presents with urinary symptoms and significant bacteriuria=  $10^5$  bacteria/ml
- Asymptomatic bacteriuria when the patient presents with significant bacteria in urine but without symptoms

# Prevalence of Bacteriuria in different age groups



# Classification

## Lower UTIs

Cystitis (infection of the bladder; superficial mucosal infections)

Urethritis (sexually transmitted pathogens)

- urethritis in men & women

Prostatitis and Epididymitis

**Upper UTIs**    **Acute pyelonephritis**

**Chronic pyelonephritis**

**Uncomplicated UTI** (empirical therapy is possible)

**Complicated UTI** (nosocomial UTI, relapses, structural or functional abnormalities )



# Pathogenesis of cystitis

- ▶ Due to frequent irritation of the mucosal surfaces of the urethra and the bladder.
- ▶ Infection results when bacteria **ascends** to the urinary bladder . These bacteria are residents or transient members of the perineal flora, and are derived from the large intestine flora.
- ▶ Toxins produced by uropathogens.
- ▶ **Conditions that create access to bladder are:**
  - Sexual intercourse due to short urethral distance.
  - Catheterization of the urinary bladder , instrumentation



# Pathogenesis of cystitis

- ▶ **Haematogenous** through blood stream from other sites of infection (less common).
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# Cystitis



- ▶ **In women :** cystitis is common due to a number of reasons:
  - Short urethra
  - Pregnancy
  - Decreased estrogen production during menopause.
- ▶ **In men:** mainly due to persistent bacterial infection of the prostate.

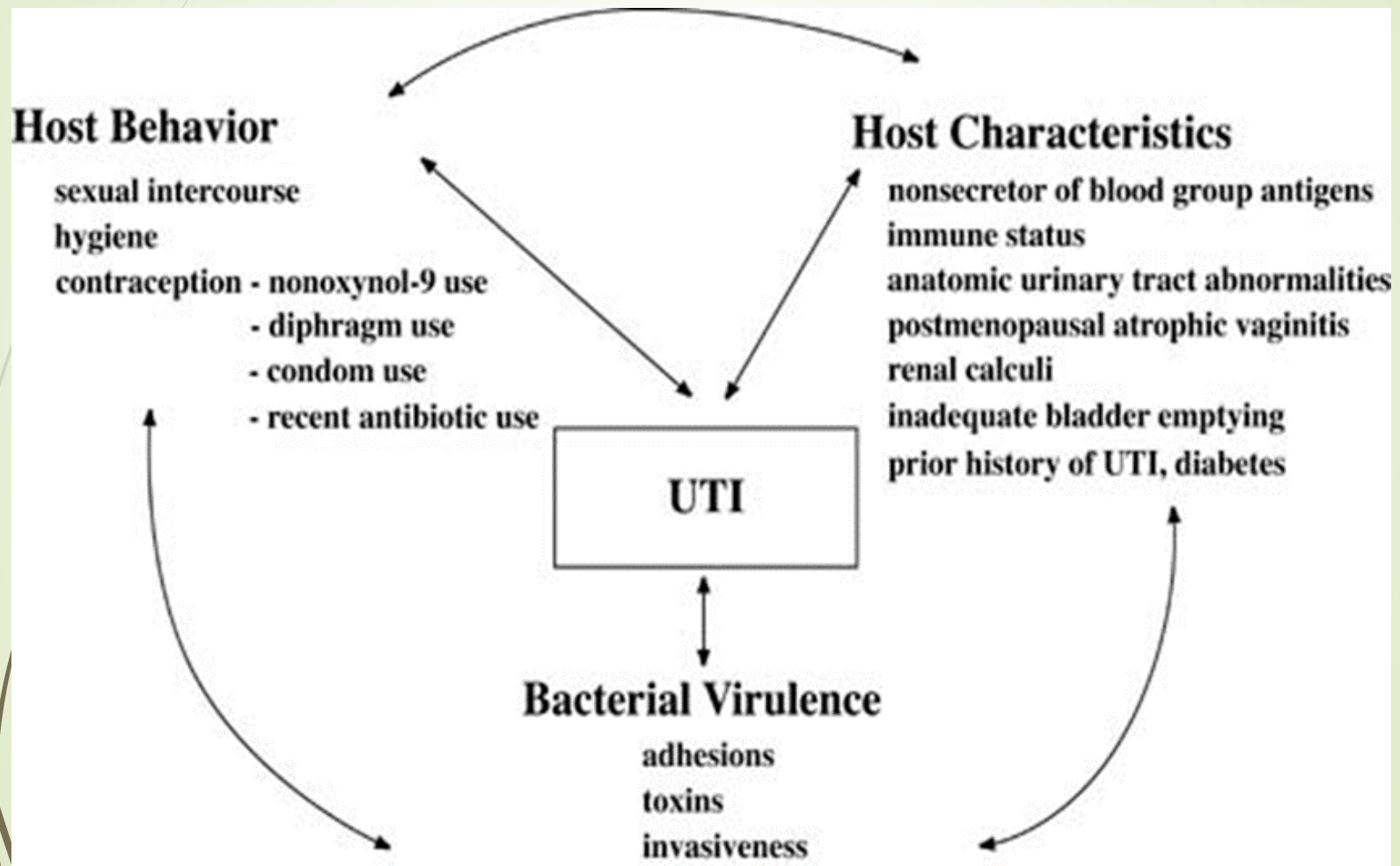


# Cystitis



- ▶ **In both sexes:** common risk factors are :
  - Presence of bladder stone
  - Urethral stricture
  - Catheterization of the urinary tract
  - Instrumentation
  - Diabetes mellitus
  - Obstruction
  - Structural abnormalities
  
- ▶ **Uncomplicated UTI** usually occurs in non pregnant, young sexually active females without structural or neurological abnormalities

# Pathogenesis





# Etiologic agents

- ***E.coli*** is the most common (90%) cause of cystitis. Other *Enterobacteriaceae* include (*Klebsiella pneumoniae*, *Proteus* spp.) Other gram negative rods eg. *P.aeruginosa*.
- **Gram positive bacteria:** *Enterococcus faecalis*, group B *Streptococcus* and *Staphylococcus saprophyticus* {honeymoon cystitis}.
- *Candida* species
- Venereal diseases (gonorrhoea, Chlamydia) may present with cystitis.
- *Schistosoma haematobium* in endemic areas.

# Pathogens involved

## Uncomplicated UTI

*E. coli* 64%  
*Enterobacteriaceae* 16%  
*Enterococcus* spp 20%  
*Pseudomonas* spp <1%  
*S. aureus* <1%

## Special cases

*S. epidermidis*  
*S. saprophyticus*  
Yeasts (catheter related)  
Viruses (Adenovirus, Varicella)  
*Chlamydia trachomatis*

## Complicated UTI

*E. coli*  
*Enterobacteriaceae*  
*Pseudomonas* spp  
*Acinetobacter* spp

(% is not possible to

judge, often multi-resistant strains)

# Clinical presentation

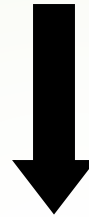
Symptoms usually of acute onset.

- Dysuria (painful urination)
- Frequency (frequent voiding)
- Urgency (an imperative call for toilet)
- Hematuria (blood in urine) in 50% of cases.
- Usually no fever.

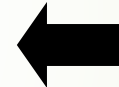




**Vaginitis (5%)**  
*Candida* spp.  
*T. vaginalis*



**Urethritis (10-15%)**  
*C. trachomatis*,  
*N. gonorrhoeae*  
*H. simplex*  
Other bacteria?



**Dysuria and  
frequency**



**Non-infectious (<1%)**  
Hypoestrogenism  
Functional obstruction  
Mechanical obstruction  
Chemicals



**Cystitis (80%)**  
*E. coli*,  
*S. saprophyticus*  
*Proteus* spp.  
*Klebsiella* spp.





# How to differentiate between cystitis and urethritis ?

- Cystitis is of more acute onset
- More sever symptoms
- Pain, tenderness on the supra-pubic area.
- Presence of bacteria in urine (*bacteriuria*)
- Urine cloudy, malodorous and may be bloody



# Differential diagnosis (types of cystitis)

➤ Non-infectious cystitis such as:

1. **Traumatic cystitis** in women
2. **Interstitial cystitis** ( unknown cause, may be due to autoimmune attack of the bladder)
3. **Eosinophilic cystitis**
4. **Hemorrhagic cystitis** due to radiotherapy or chemotherapy.





# Laboratory diagnosis of cystitis

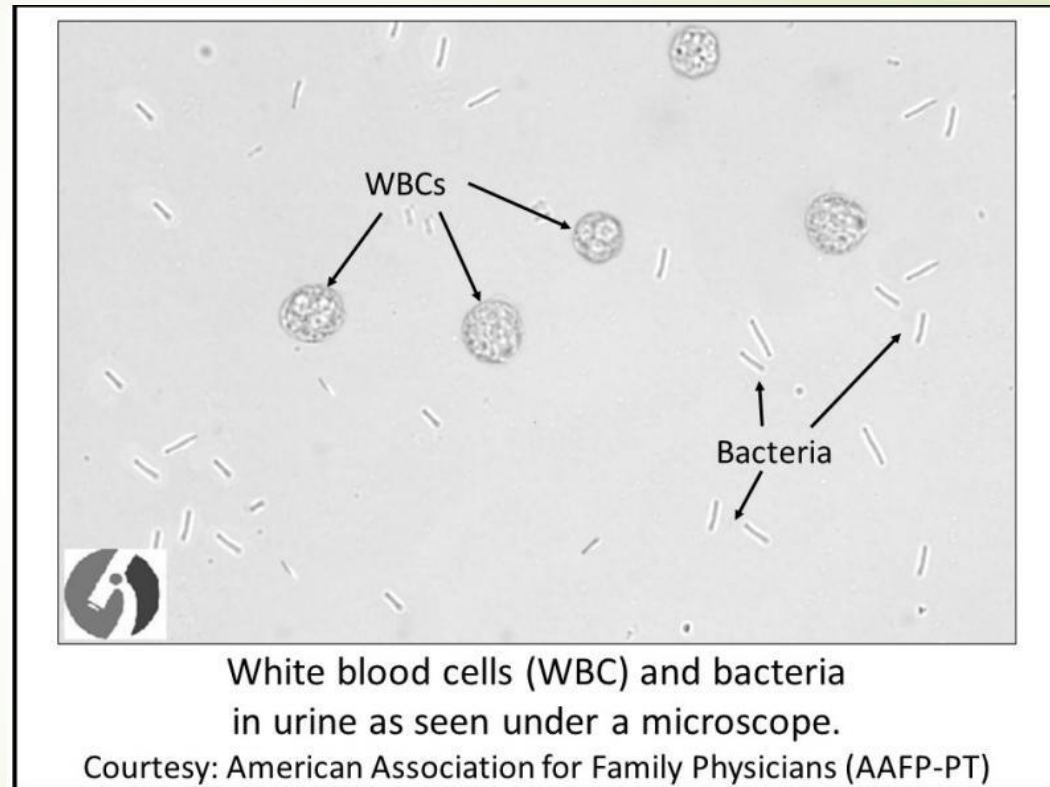
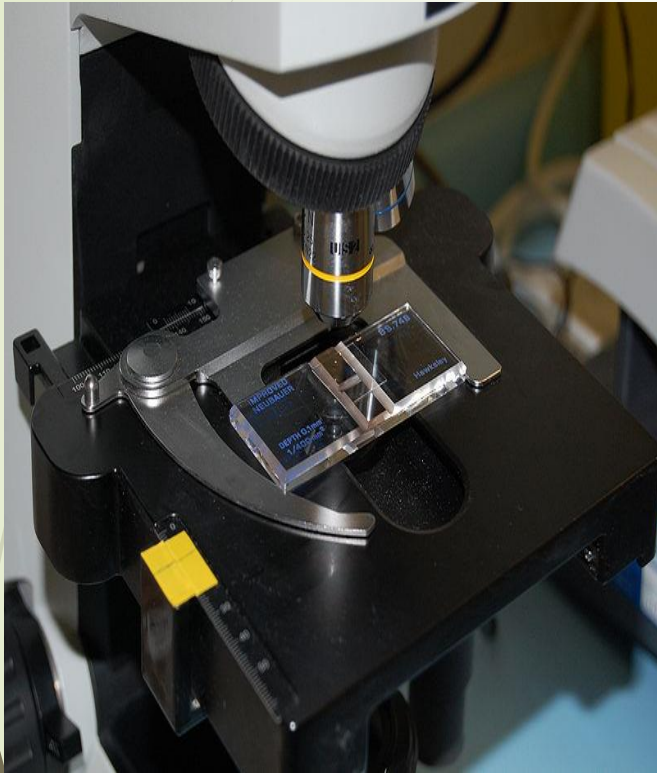
## 1. Specimen collection:

- Most important is clean catch urine [Midstream urine (**MSU**)] to bypass contamination by preneal flora and must be *before starting antibiotic*.
- **Supra-pubic aspiration** or **catheterization** may be used in children.
- Catheter urine should not be used for diagnosis of UTI.



## 2- **Microscopic examination:**

- About 90% of patients have **> 10 WBCs /cu.mm**
- Gram stain of uncentrifuged sample is sensitive and specific.
- One organism per oil-immersion field is indicative of infection.
- Blood cells, parasites or crystals can be seen



White blood cells (WBC) and bacteria  
in urine as seen under a microscope.

Courtesy: American Association for Family Physicians (AAFP-PT)



### 3- Chemical screening tests:

- **Urine dip stick** –rapid, detects *nitrites* released by bacterial metabolism and *leukocyte esterase* from inflammatory cells. Not specific.

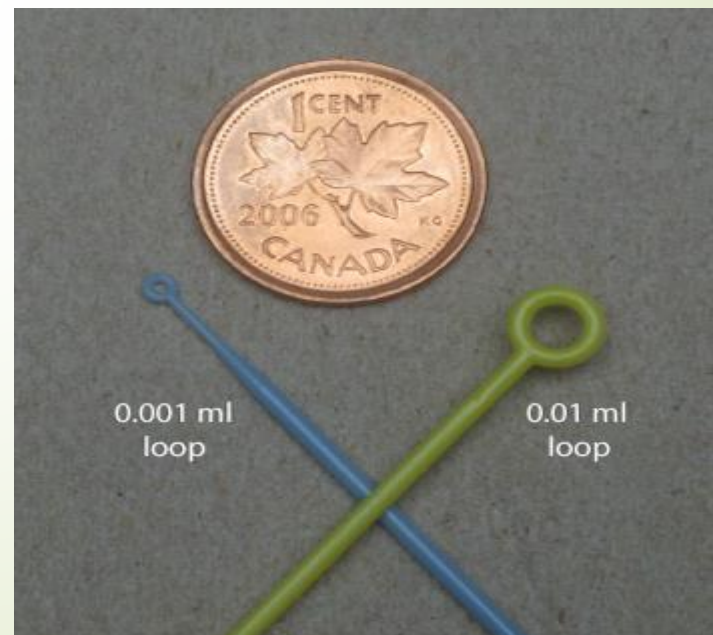
### 4- Urine culture: important to identify bacterial cause and antimicrobial sensitivity .

- **Quantitative culture** typical of UTI ( >100,000 cfu/ml)  
Lower count (<100,000 or less eg. 1000 cfu/ml ) is indicative of cystitis if the patient is *symptomatic*.



### Urinalysis (sample collected after fluid therapy)

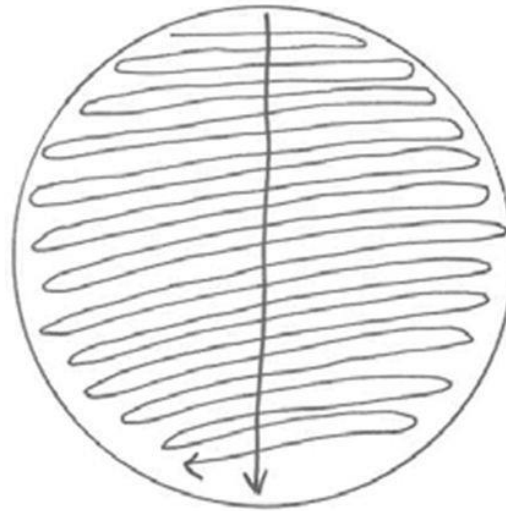
Specimen	Cystocentesis
Color	Yellow
Appearance	Cloudy
Specific gravity	1.014
pH	5.5
Protein	Trace
Glucose	3+
Ketones	1+
Bilirubin	1+
Blood	2+
Urobilinogen	0.2
Bacteria	Negative
Epithelial cells	0-3



# Quantitative urine culture

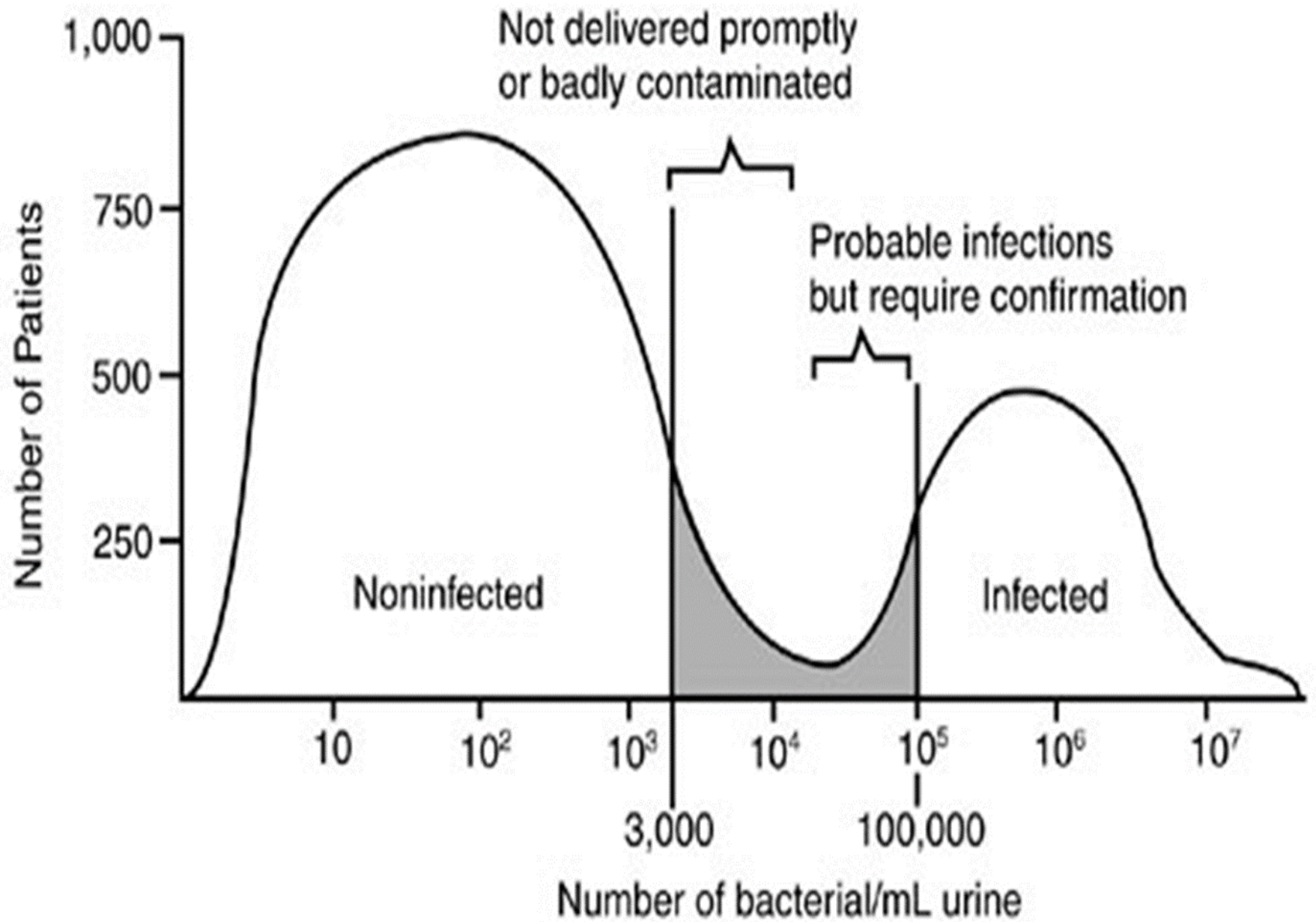
## URINE PLATE TECHNIQUE

CALIBRATED LOOP: 0.001  $\mu\text{L}$  vs. 0.01  $\mu\text{L}$



**Inoculation: dip calibrated loop in urine, streak down middle of agar plate, then with the same loop go back and streak across the center inoculum to dilute**

- Using 0.001/ml loop
  - 1 colony = 1000 CFU/ml
  - 100 colonies = 100,000 CFU/ml





# Recurrent cystitis

- ▶ Three or more episodes of cystitis /year
- ▶ Requires further investigations such as Intra-Venous Urogram (**IVU**) or Ultrasound to detect obstruction or congenital deformity.
- ▶ Cystoscopy required in some cases.





# Treatment of cystitis

- **Empiric treatment** commonly used depending on the knowledge of common organism and sensitivity pattern.
- **Treatment best guided by susceptibility pattern of the causative bacteria.**
- Common agents: Ampicillin or Amoxicillin, Amoxicillin-Clavulanic acid , Cephradine, Ciprofloxacin, Norfloxacin, Gentamicin or TRM-SMX.



# Treatment of cystitis

- **Duration** of treatment: three days for uncomplicated cystitis
- 10-14 days for complicated and recurrent cystitis.
- **Prophylaxis** required for recurrent cases by Nitrofurantoin or TRM-SMX.
- **Prevention** : drinking plenty of water and prophylactic antibiotic.



# Reference

- ▶ Ryan, Kenneth J. Sherris Medical Microbiology. Latest edition. McGraw – Hill Education