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

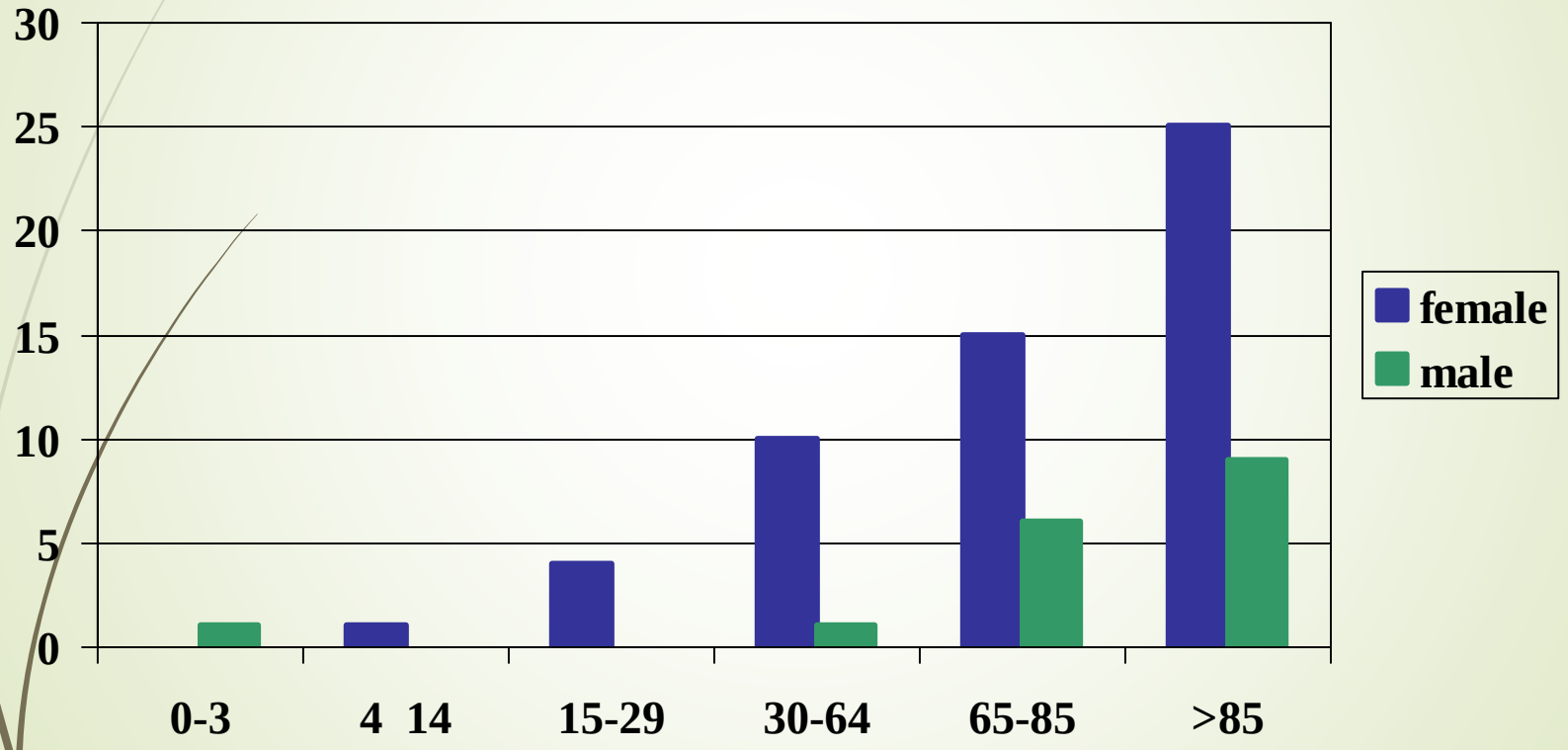
6- Describe the laboratory diagnosis of cystitis

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).

Cystitis

- **In women :** cystitis is common due to a number of reasons:

  - Short urethra
  - Pregnancy
  - Decreased estrogen production during menopause.

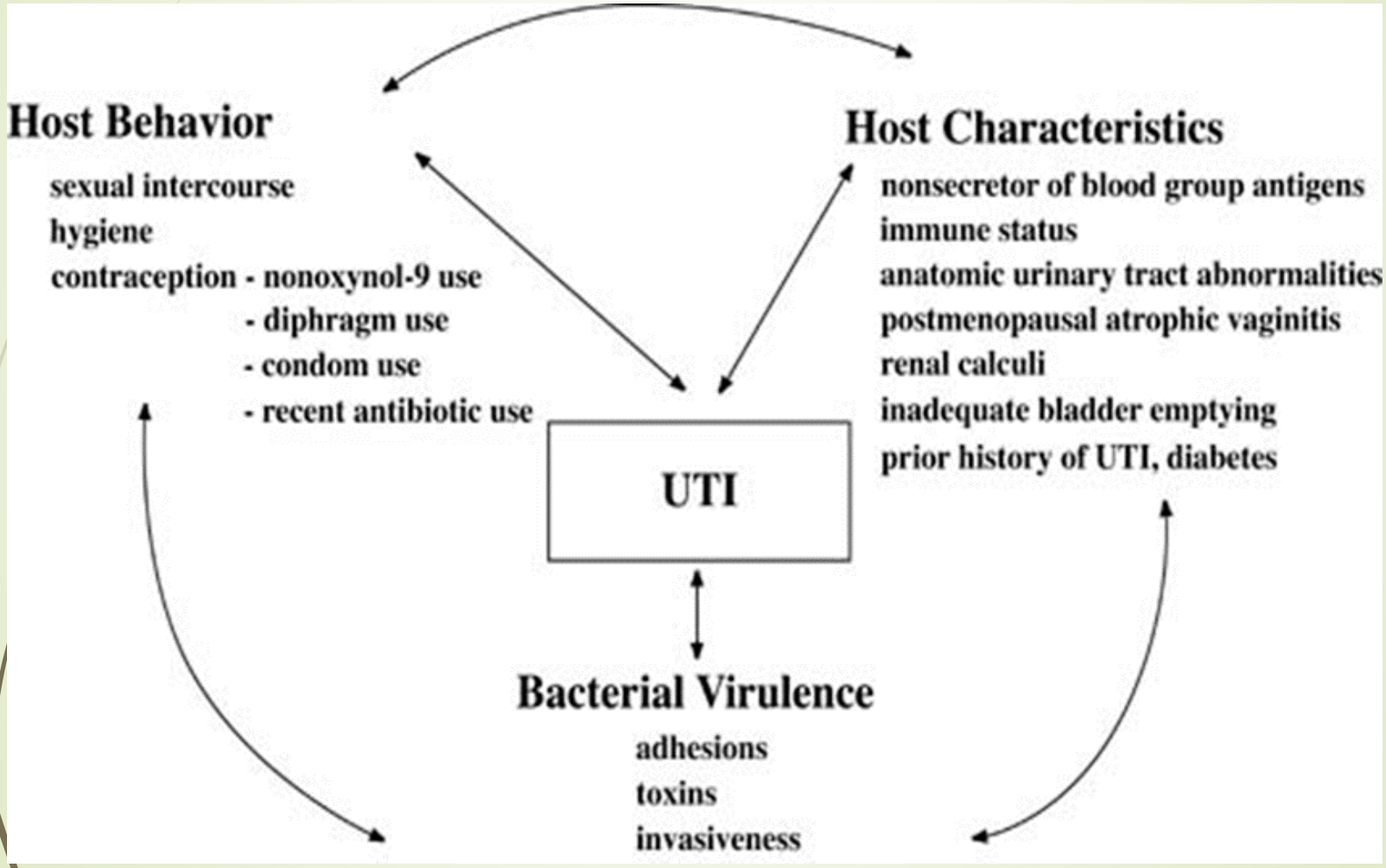
- **In men**: mainly due to persistent bacterial infection of the prostate.

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.aeroginosa*.
- **Gram positive bacteria**: *Enterococcus faecalis*, group *B Streptococcus* and *Staphylococcus saprophyticus* {honeymoon cystitis}.
- *Candida* species
- Venereal diseases (gonorrhea, 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

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

Dysuria and frequency

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

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

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. **Hemorrahagic cystitis** due to radiotherapy or chemotherapy.

Laboratory diagnosis of cystitis

1. **Specimen collection:**

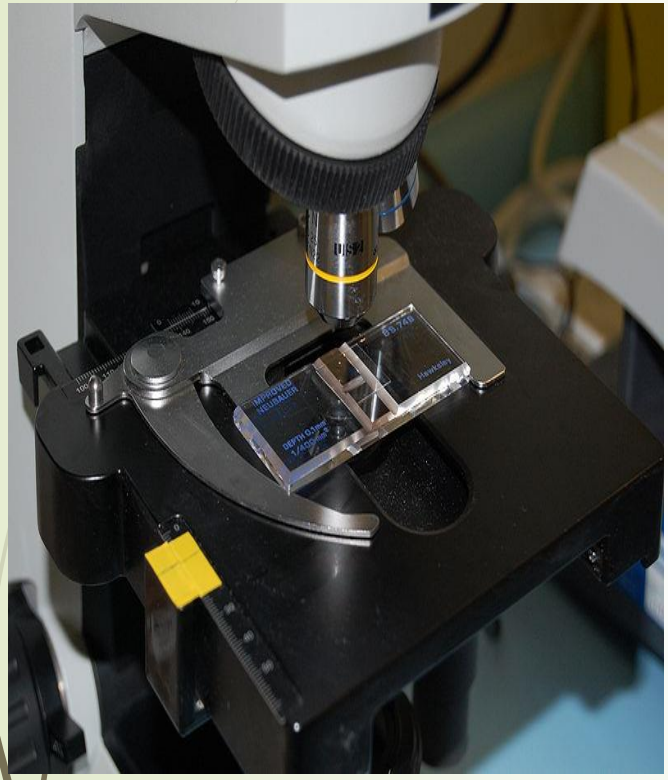
- Most important is clean catch urine [Midstream urine (**MSU**)] to bypass contamination by preneal flora *and must be before starting antibiotic*.

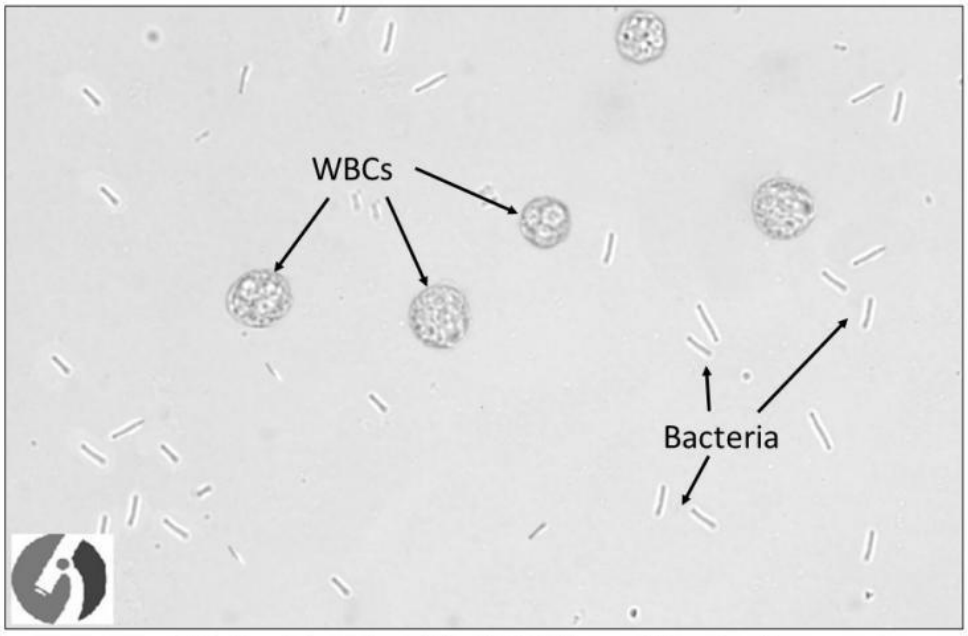
- **Supra-pubic aspiration** or **catheterization** may be used in children.

- 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 can be done.
- 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:**

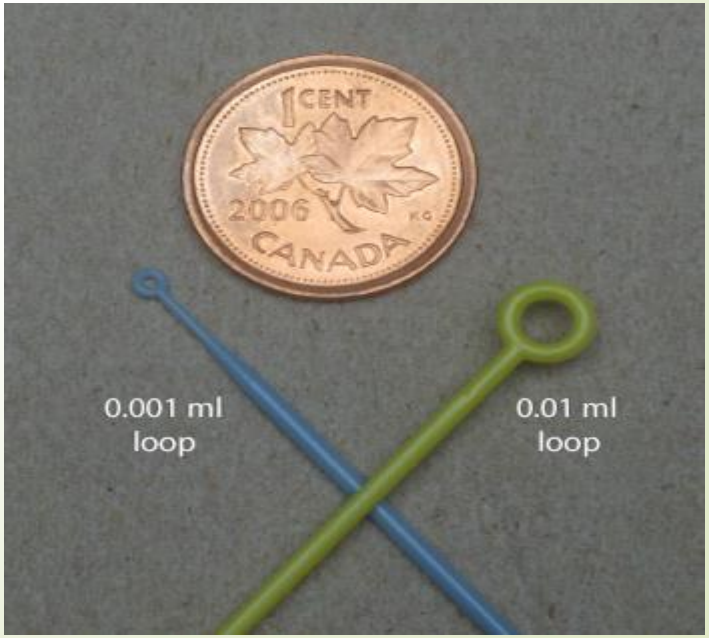
- **Urine dip stick** –rapid, detects *nitrites* released by bacterial metabolism and *leukocyte esterase* from inflammatory cells. Not specific.

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

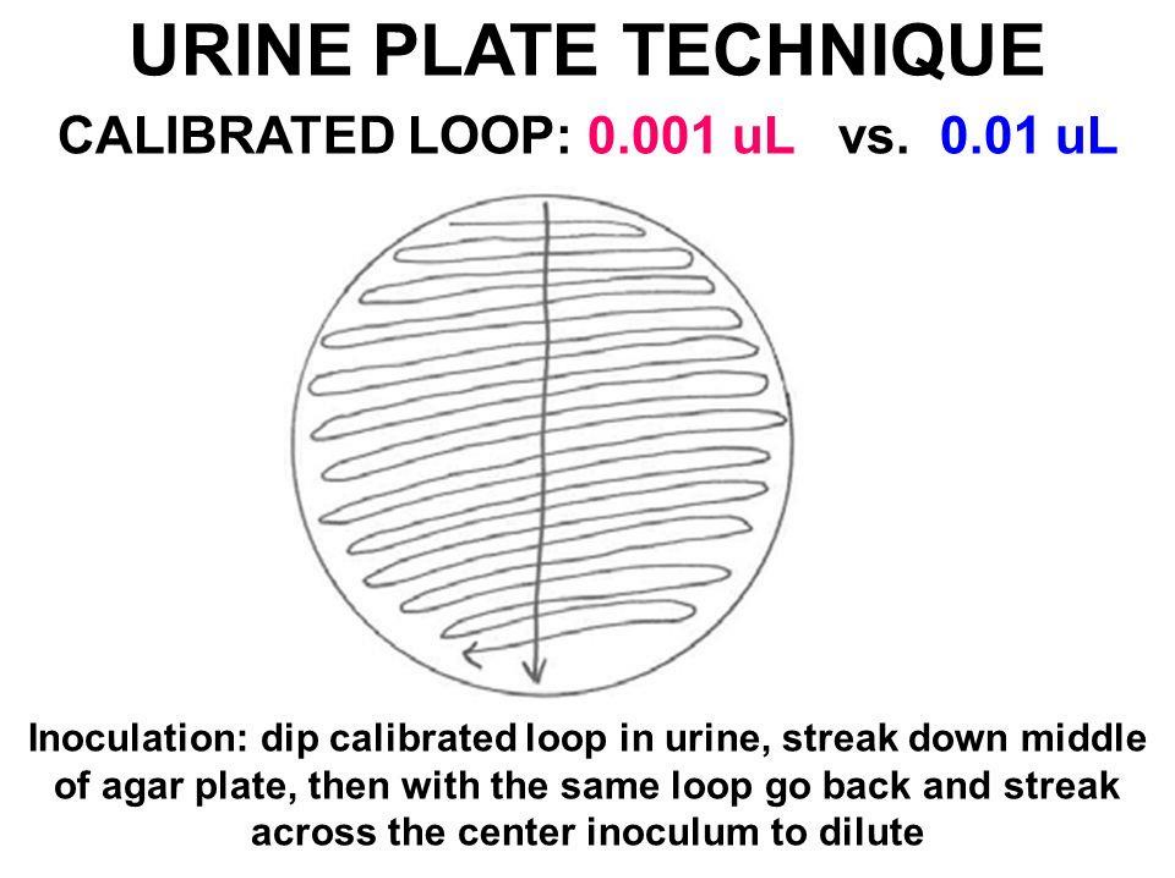
- **Quantitative culture** typical of UTI (>100,000 cfu/ml) Lower count (<100,000 or less eg. 1000 cfu/ml) is indicative of cystitis if the patient is *symptomatic*.

Urinalysis (sample collected after fluid therapy)

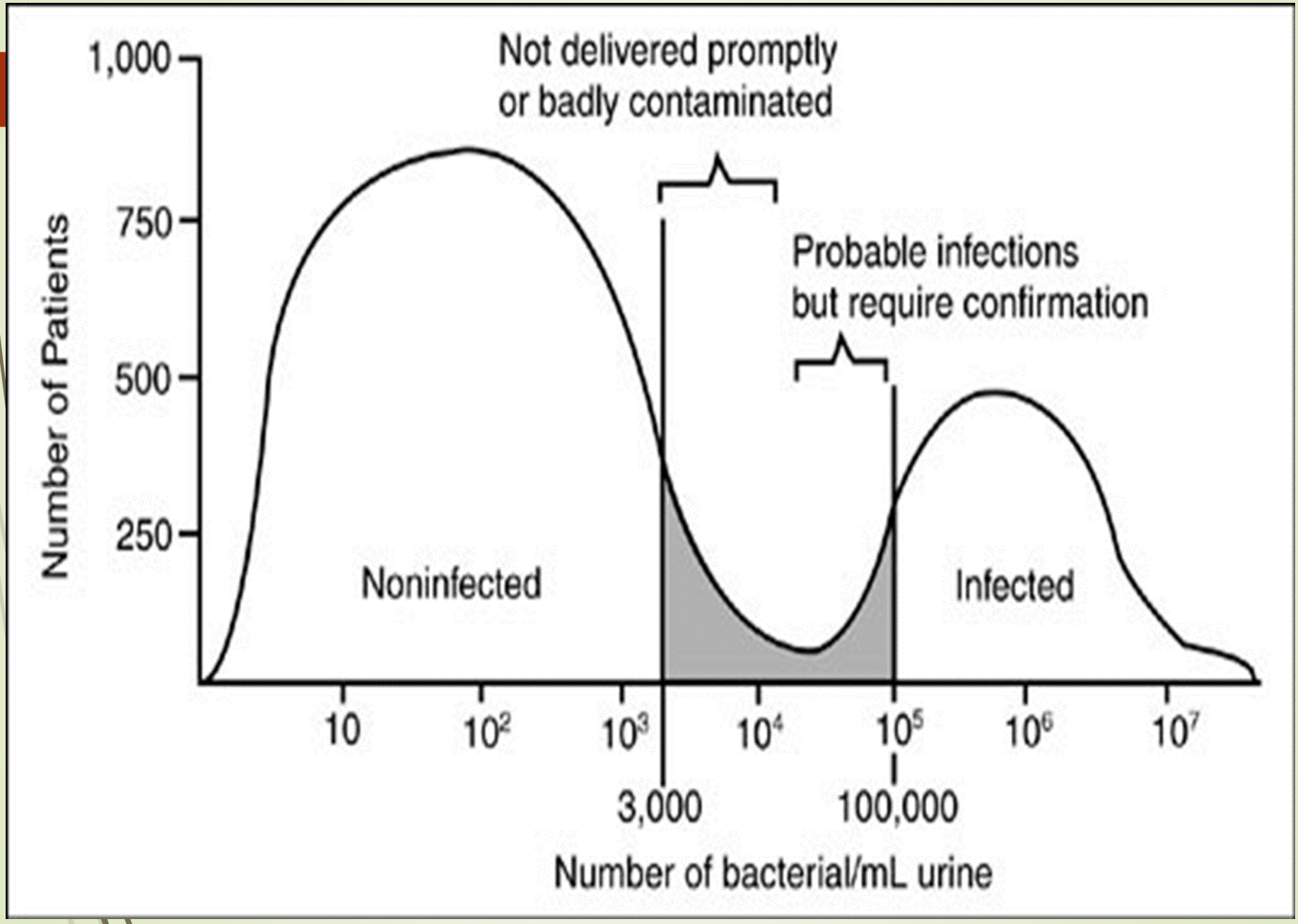
Specimen	Cystocentesis
Color	Yellow
Appearance	Cloudy
Specific gravity	1.014
pH	5.5
Protein	Trace
Glucose	3+
Ketones	1+
Bilirubin	1+
Blood	2+
Urobilinogen	0.2
Bacteria	Negative
Epithelial cells	0–3



Quantitative urine culture



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


1,000
750
500
250
Number of Patients
Not delivered promptly
or badly contaminated
Probable infections
but require confirmation
Noninfected
Infected
10
10²
10³
10⁴
10⁵
10⁶
10⁷
3,000
100,000
Number of bacterial/mL urine

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 Amoxacillin, Amoxacillin-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