Urinary tract infections
UTI

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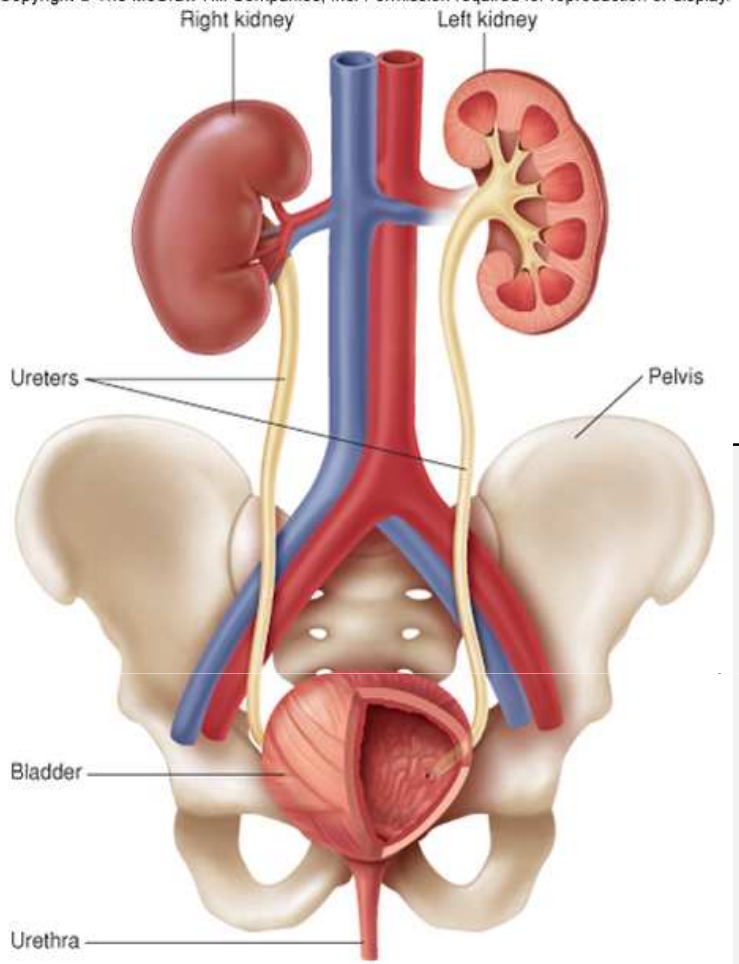
Objective

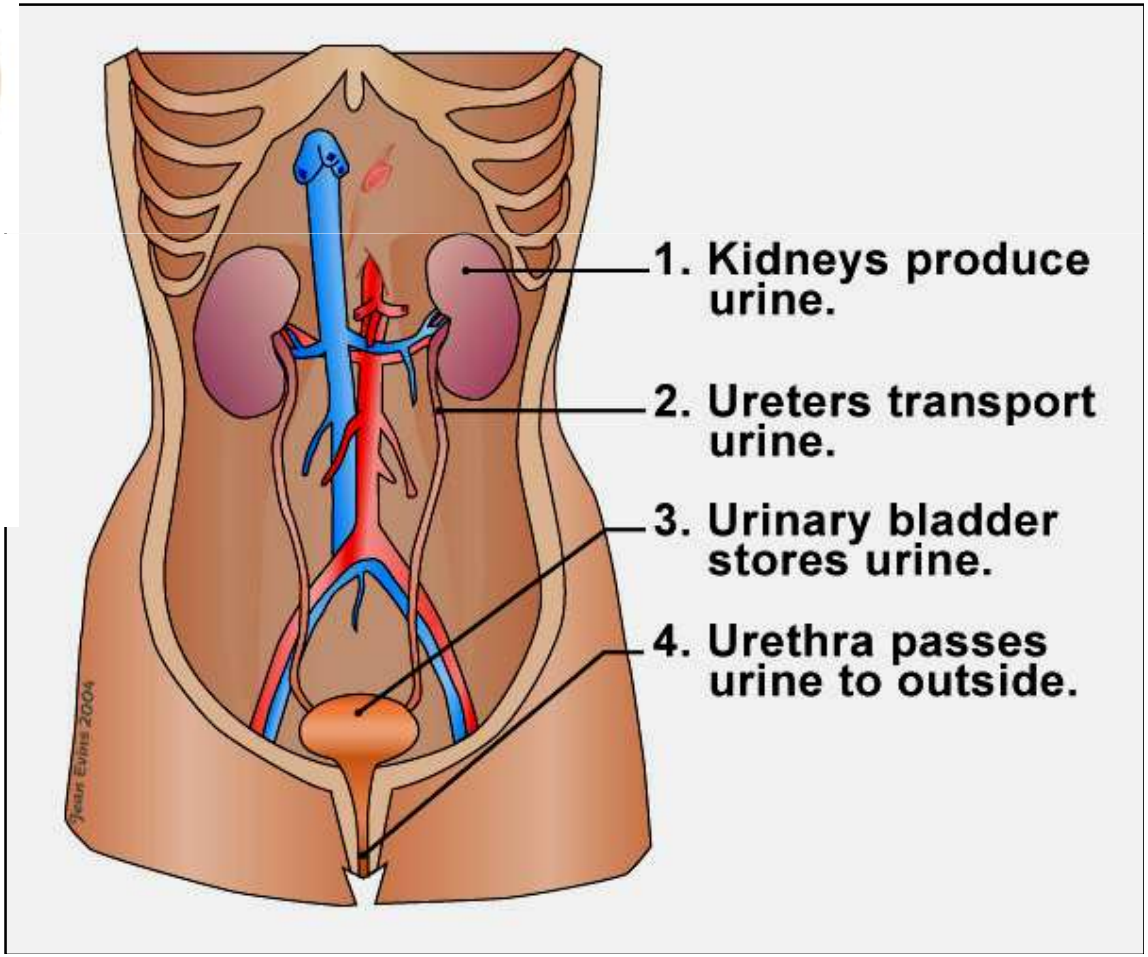
- What is UTI ?
- Types of UTI
- Clinical features
- Causative organisms
- Types of specimen
- Laboratory techniques

What is UTI ?

- Microbial invasion of genito-urinary tract anywhere from renal cortex to urethra
- Defined in terms of
  - Significant bacteriuria
  - Presence of > 1,00,000 (> 10^5) bacteria/ml
- Pyuria

Anatomy

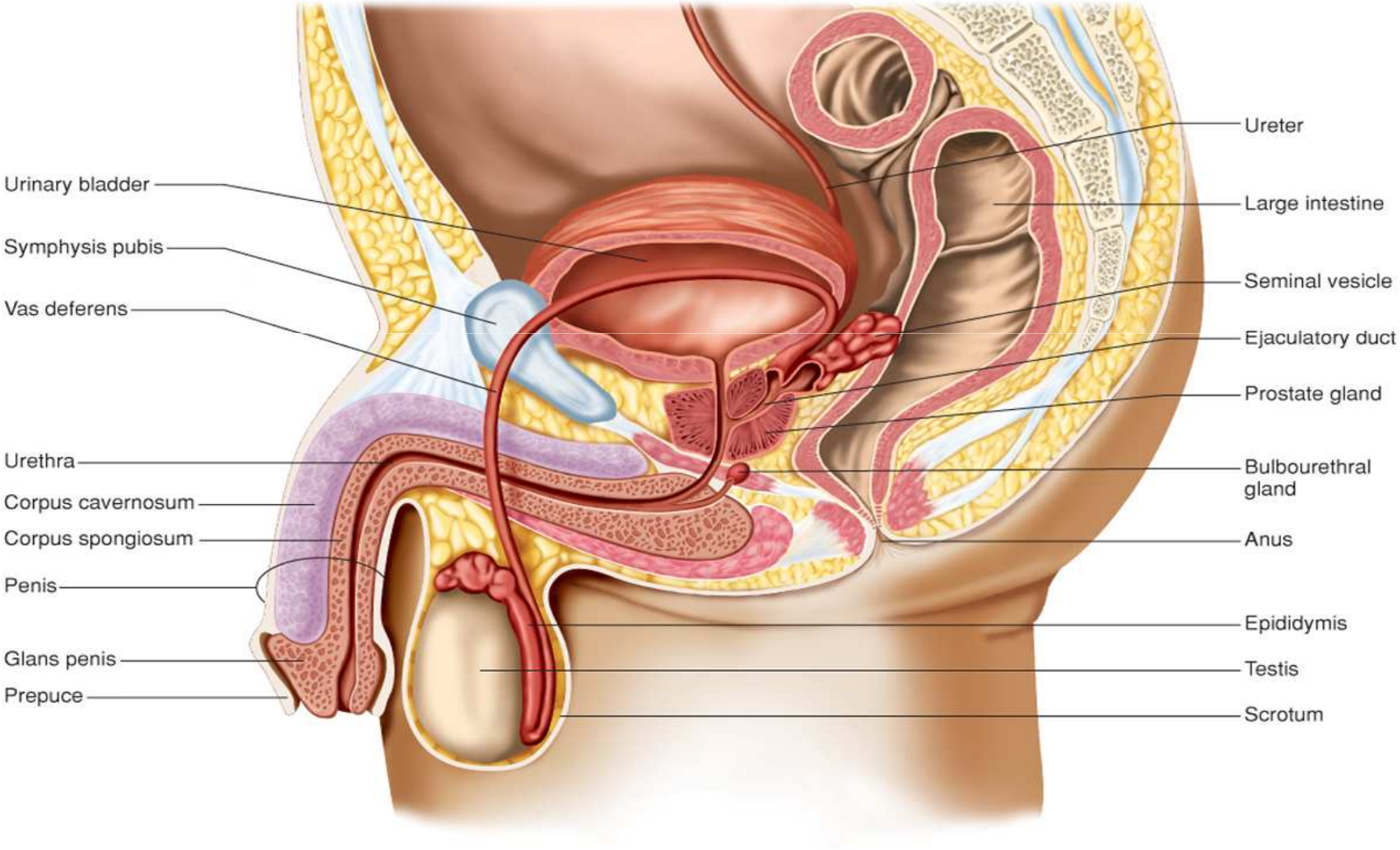




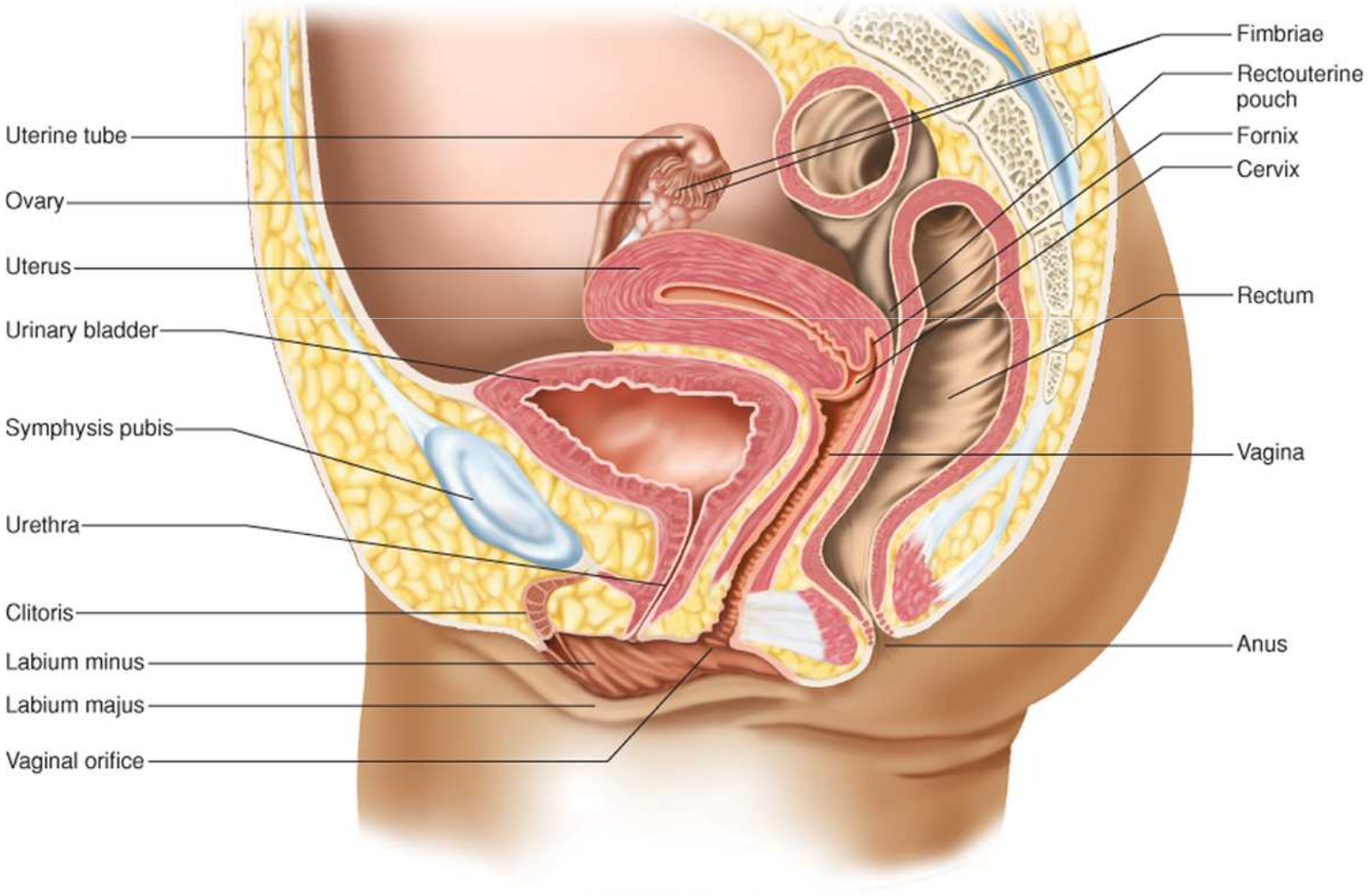
Epidemiology of UTI

- **10 % humans have UTI once during their life time**
- **Second most common nosocomial infection**
- **In men: prevalence is low compared to females**
- **Incidence of UTI in male also increases in old age . (10% of men & 20% of women)**

Differences in anatomy of male & female urinary tract

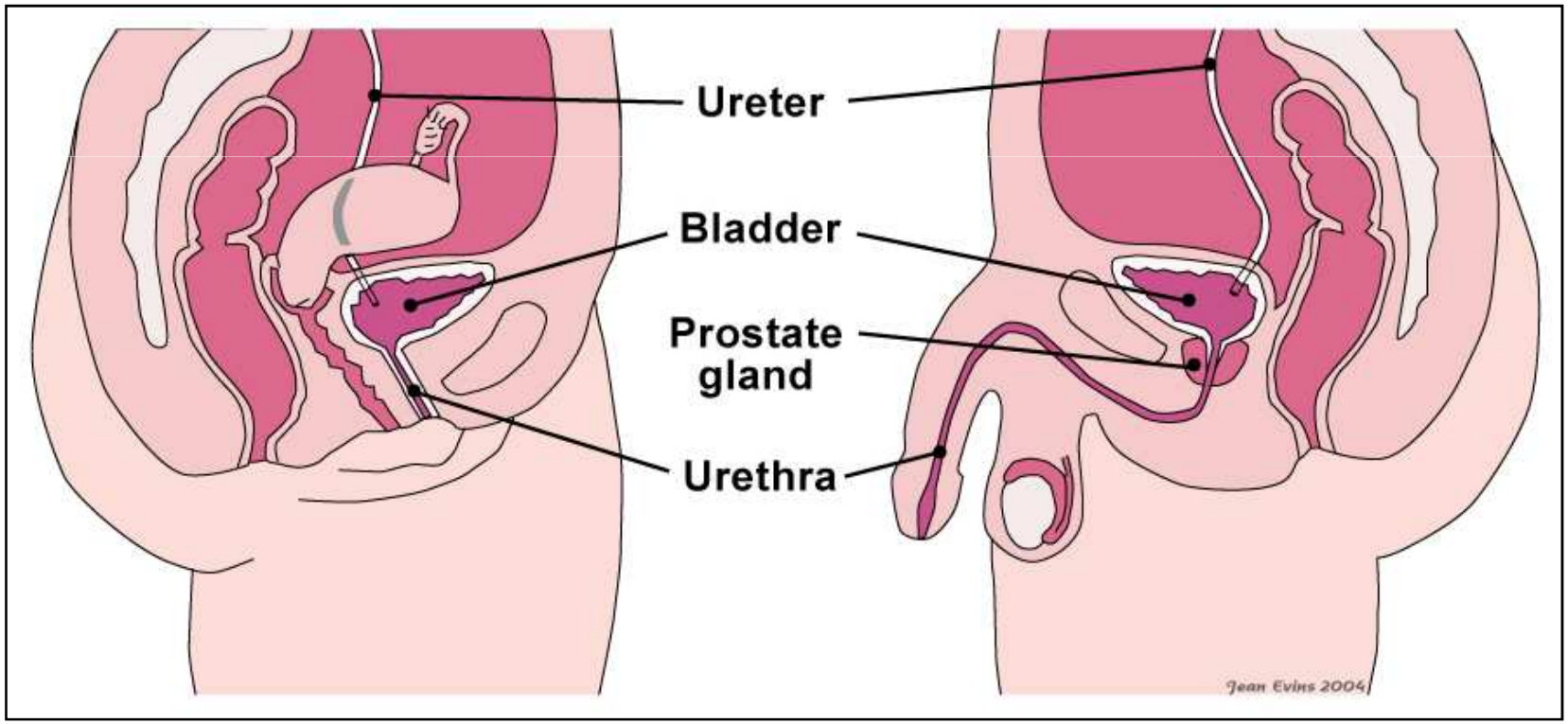


In females, urethra is shorter, straighter and in close proximity to anus



Women may have more UTIs than men because:

1) In females urethra is shorter, straighter and close proximity to anus allowing quicker access to the bladder
2) Sexual activity may result in UTIs in women



Resident microbial flora

- CONS
- Diptheroides
- Lactobacilli
- Viridans streptococci
- Non-pathogenic Neisseriae
- Anaerobic GNB
- Propionibacterium
- Commensal mycobacteria

Etiological agents

Bacteria	*Virus*	*Fungi*	*Parasites*
Gram-negative bacilli • *E.coli* • *Proteus* species • *Klebsiella* • *Enterobacter* • *Pseudomonas*	Adenovirus	*Candida albicans*	*Trichomonas vaginalis*
Gram-positive cocci • *Staphylococcus aureus* • *Staphylococcus epidermidis* • *Staphylococcus saprophyticus* • *Enterococcus* species			*Schistosoma haematobium*
Gram-negative cocci • *Neisseria gonorrhoeae*			*Enterobius vermicularis*
Others • *Mycobacterium tuberculosis* • *Salmonella* species • *Gardnerella vaginalis*			

PATHOGENESIS

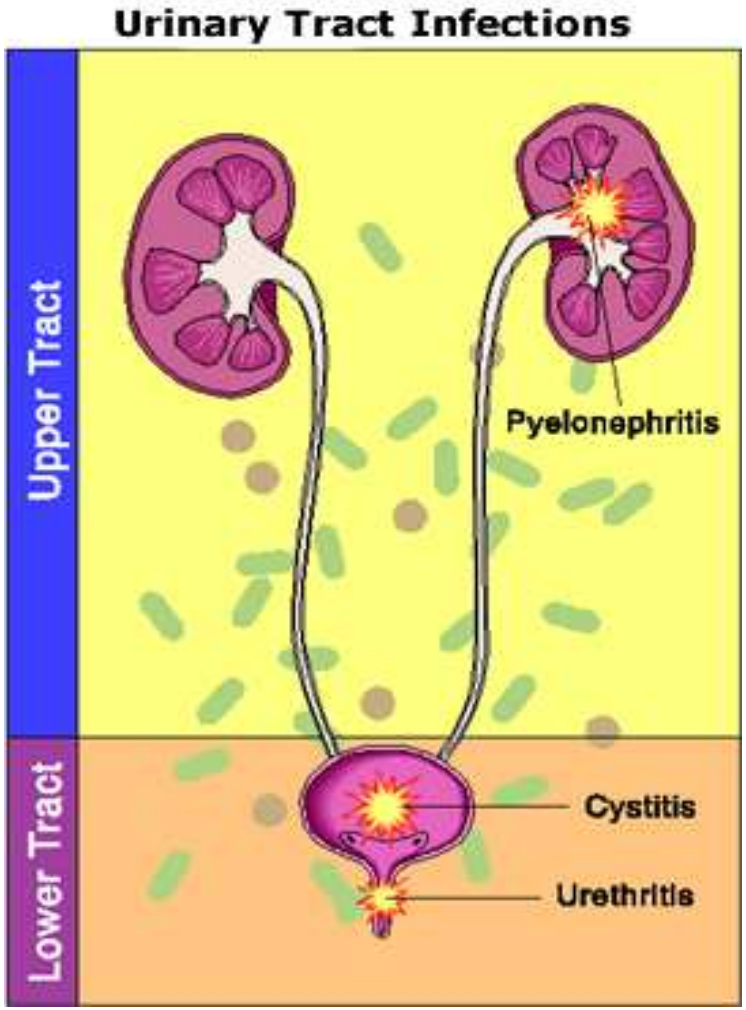
- ***Upper urinary tract infection:***

  Pyelonephritis

- ***Lower urinary tract infection:***

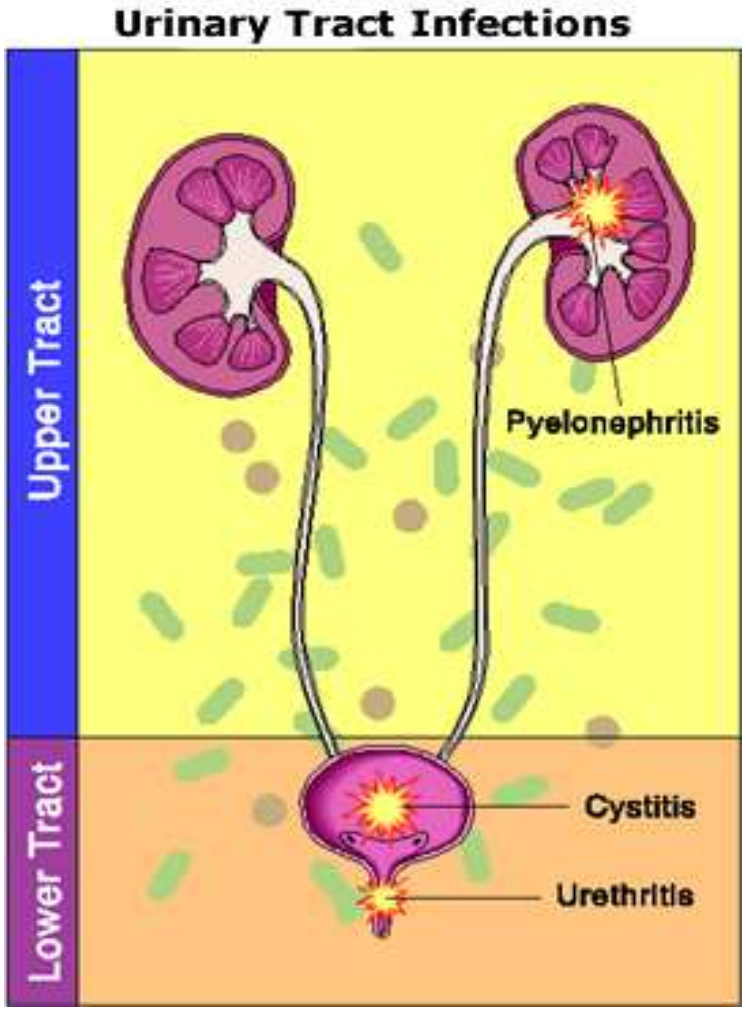
  Cystitis

  Urethritis



Pathogenesis

- UTI acquired via two routes
- Ascending
  - Most common route – 95 %
- Descending/Haematogenous
  - Mycobacteria
  - Salmonella
  - Staphylococcus aureus
  - Leptospira
  - Candida



Predisposing factors

- Physiological factors
- Sex
  - Age
  - Pregnancy
- Structural & functional abnormalities of Urinary tract
  - **Structural and functional abnormality** –obstruction due to stricture, calculus, tumour or prostatic hypertrophy ,
  - Genital prolapse
  - **Intervention** – catheterisation
  - Neurogenic Bladder dysfunction
  - Vesico-ureteric reflux
- Virulence of organism

CLINICAL PRESENTATION

Clinical types

- Urethritis
- Cystitis
- Acute urethral syndrome
- Pyelonephritis

Urethritis

- Irritation around urethra
- Burning micturition
- Urethral discharge

Cystitis

- Burning micturition
- Urgency
- ↑↑ Frequency
- Tenderness over bladder
- Urine cloudiness
- Bloody urine
- Bad odour

Pyelonephritis

- All features of cystitis +
- Fever
- Flank pain
- Vomiting

LABORATORY EVALUATION

Collection of sample

- Clean catch midstream urine
- Straight catheterised urine
- Suprapubic aspiration
- Indwelling catheter

Clean catch midstream urine

- Clean periurethral area well with mild detergent
- Rinse area well after application of detergent
- Retract labial folds/glans penis & void
- First part should be allowed to flush
- Collect middle portion of stream

Bacterial count : > 10^5 cfu/ml

Straight catheterised urine

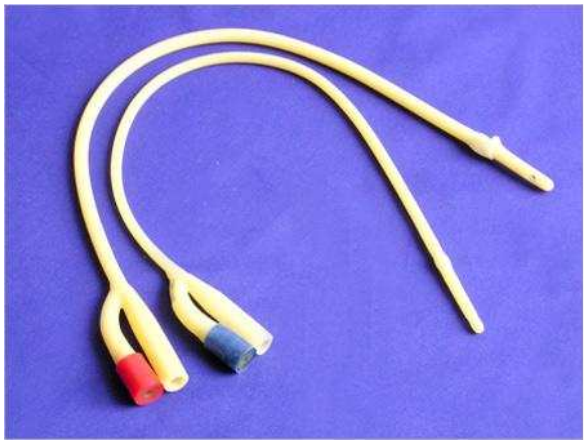
- Should always be collected by trained physician or paramedical staff
- After thorough cleansing of area, simple straight catheter is introduced into bladder
- Advantage :
  - No contamination from urethra
- Disadvantage :
  - Itself leads to UTI – 3 % of patients

Suprapubic aspiration

- Bladders should be full
- Performed mainly for infants & children who cannot produce midstream urine
- Needle is inserted percutaneously after skin preparation and urine is obtained directly from bladder

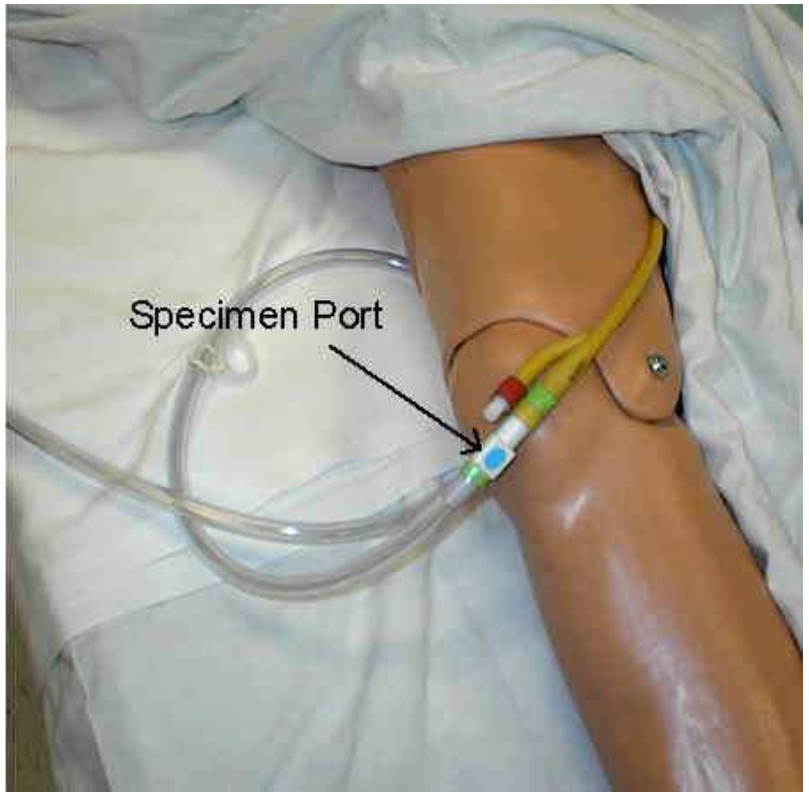
Bacterial count : any number

Indwelling catheter



- Never collect form urobag
- Clamp catheter tube above port
- Withdraw urobag from port, release clamp & collect

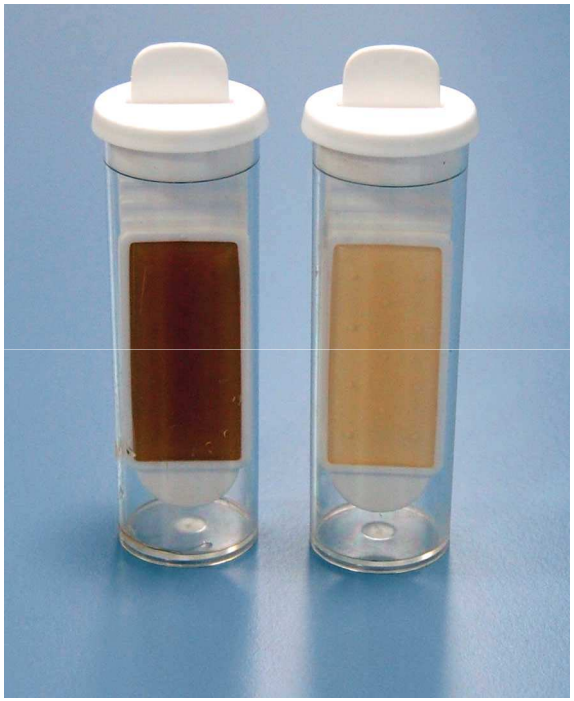
  Or
- Thoroughly clean tube with 70 % alcohol insert needle & collect in syringe

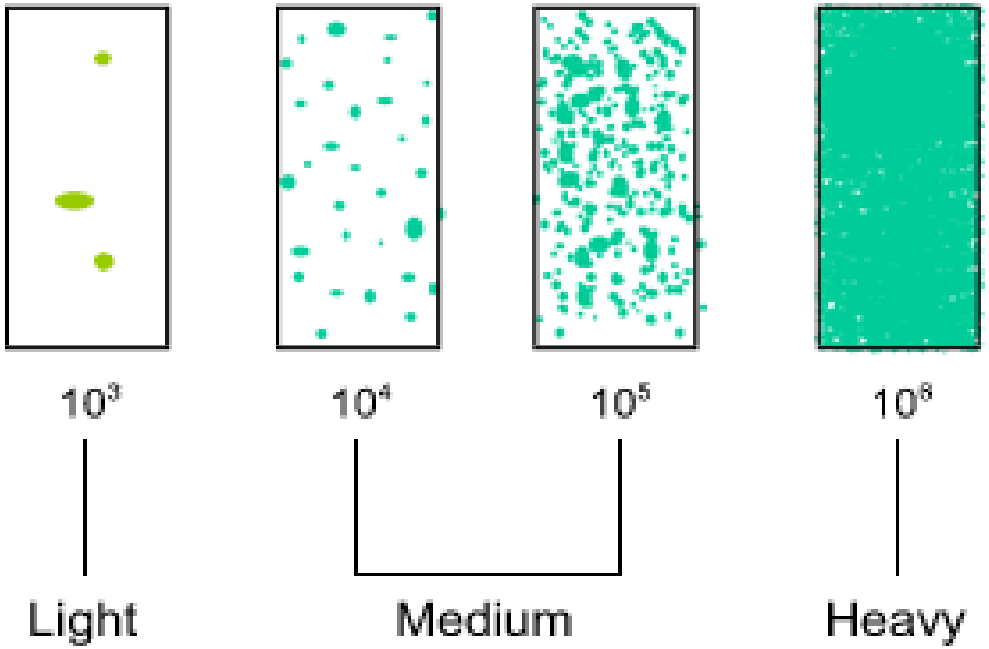


TRANSPORT OF SPECIMEN

- IMMEDIATELY
- If delay > 2 hours – refrigerate at 4-8 c
- Storage up to 24 hours possible without change in colony count
- Transport media
  - Boric acid, glycerol & sodium formate
- Use of dip slides

Dip slide technique





LABORATORY EVALUATION

Urine:

- Microscopy
- Dipstick /strips– screening techniques
- Culture & sensitivity

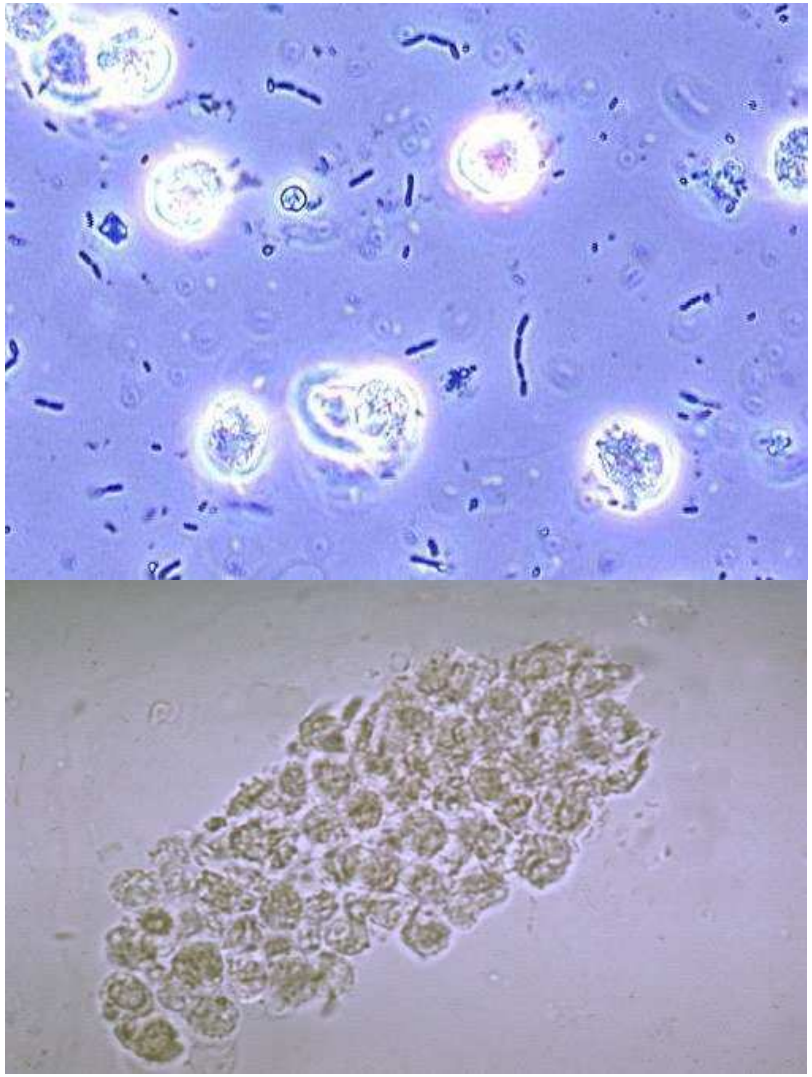
Gross examination

- Cloudy
- Turbid
- Reddish
- Odour

Clear Vs Turbid urine

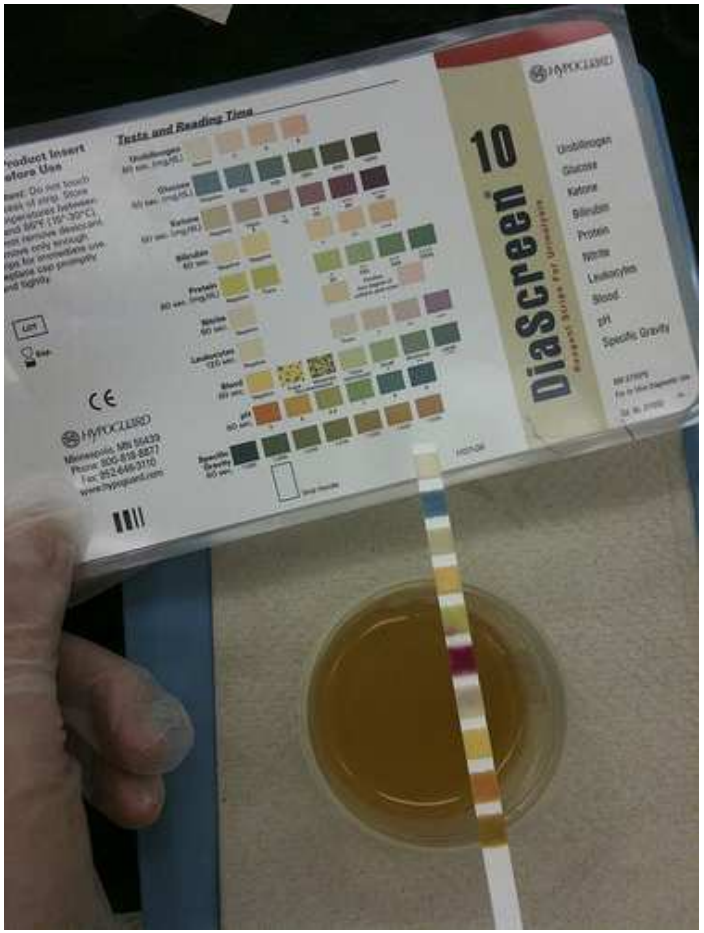
Microscopic examination (Screening technique)

- *White Blood Cells:* Centrifuged - ≥5 WBC/hpf or ≥1 WBC/hpf in an uncentrifuged sample
- *Bacteria:* bacteriuria is the presence of any bacteria/hpf
- *Gram stain*
  - *> 1 /OIF in uncentrifuged well mixed urine*



Screening techniques

- Leukocyte esterase
- Nitrite
- Catalase
- Triphenyl tetrazolium chloride test

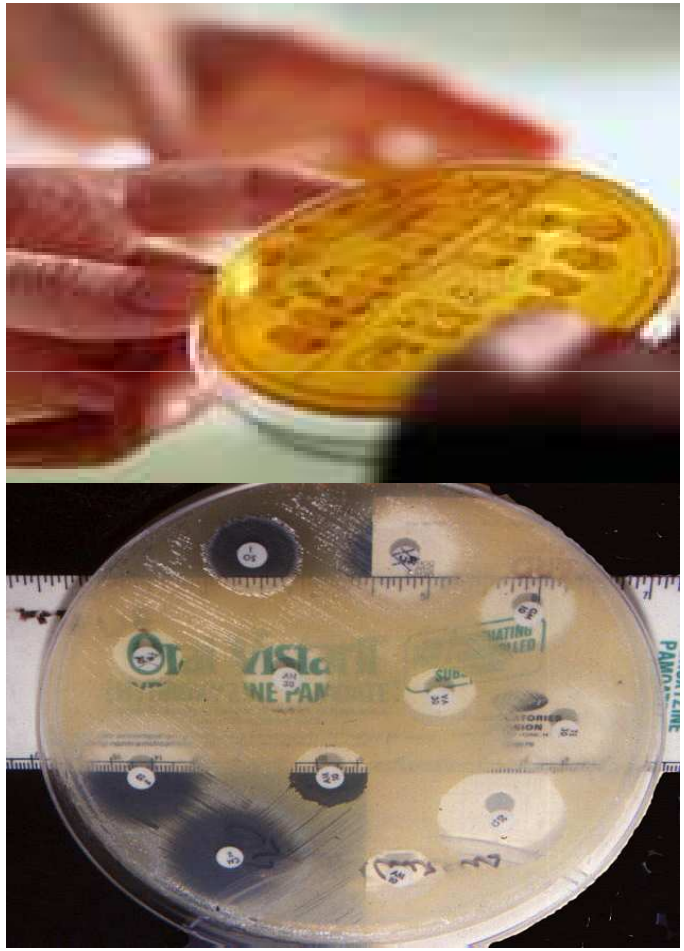


LABORATORY EVALUATION

Urine culture & sensitivity

- Urine culture is the gold standard for the diagnosis of UTI

- Urine obtained for culture should be processed as soon as possible after collection

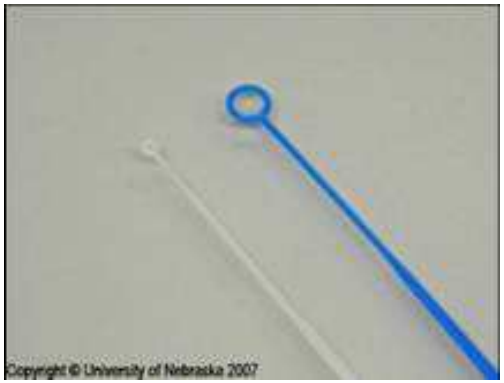


Culture techniques

- Quantitative culture
  - Significant bacteriuria – concept of Kass
- Counts less than this significant if:
  - Patient on antibiotics
  - Obstruction to urinary tract
  - Pyelonephritis present
  - Specimen collected by suprapubic aspiration
  - Pour plate culture
  - Automated counter - Coulter
- Semi quantitative culture
  - Calibrated wire loop technique
  - More popular

Calibrated wire loop technique

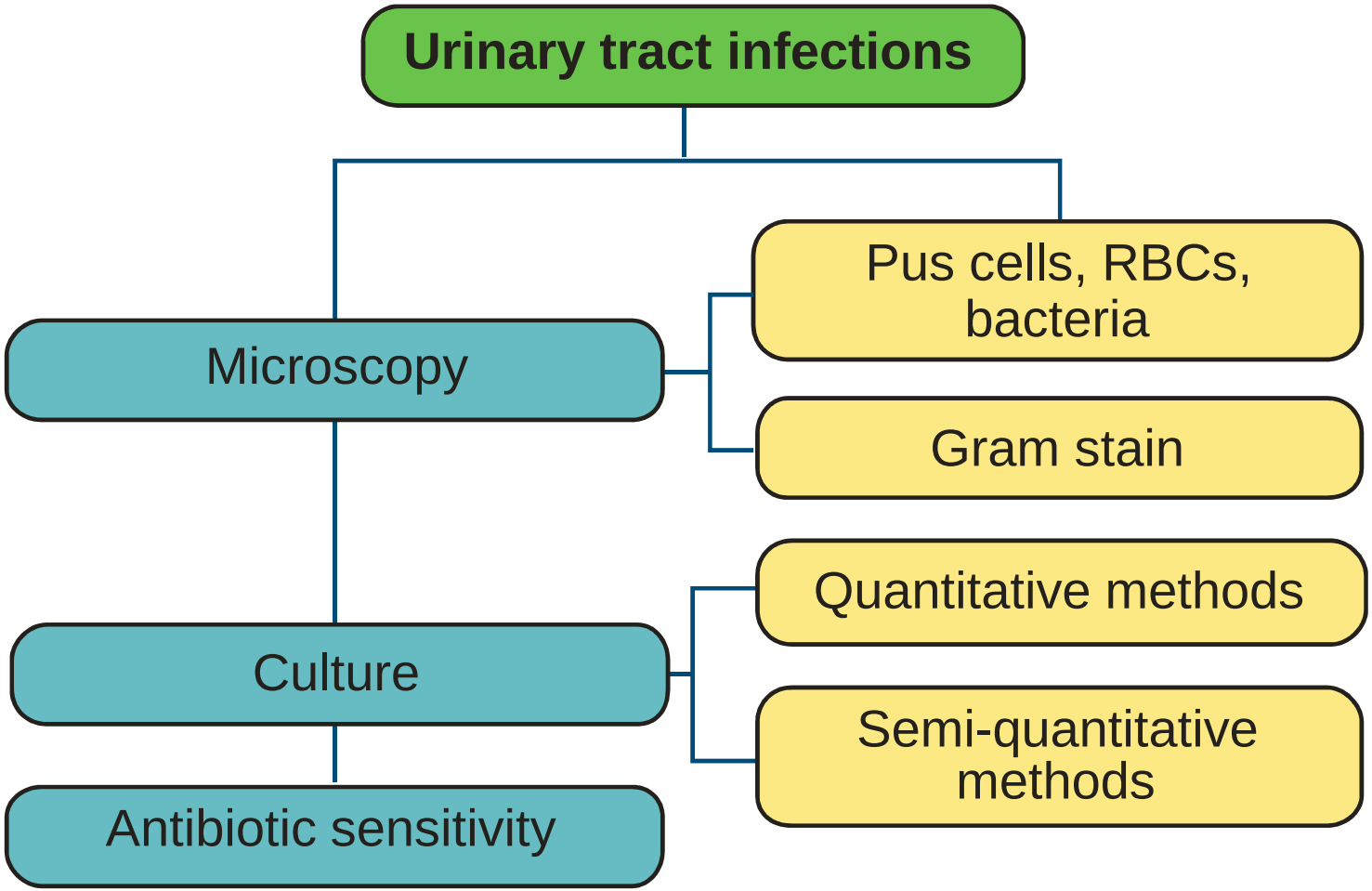
- Platinum, plastic or nichrome calibrated loop which delivers 0.01 or 0.001 ml of specimen
- Choice of media
  - Blood agar
  - Mac Conkey agar/CLED agar
- Incubation at 37 c -24 hours



Colony count

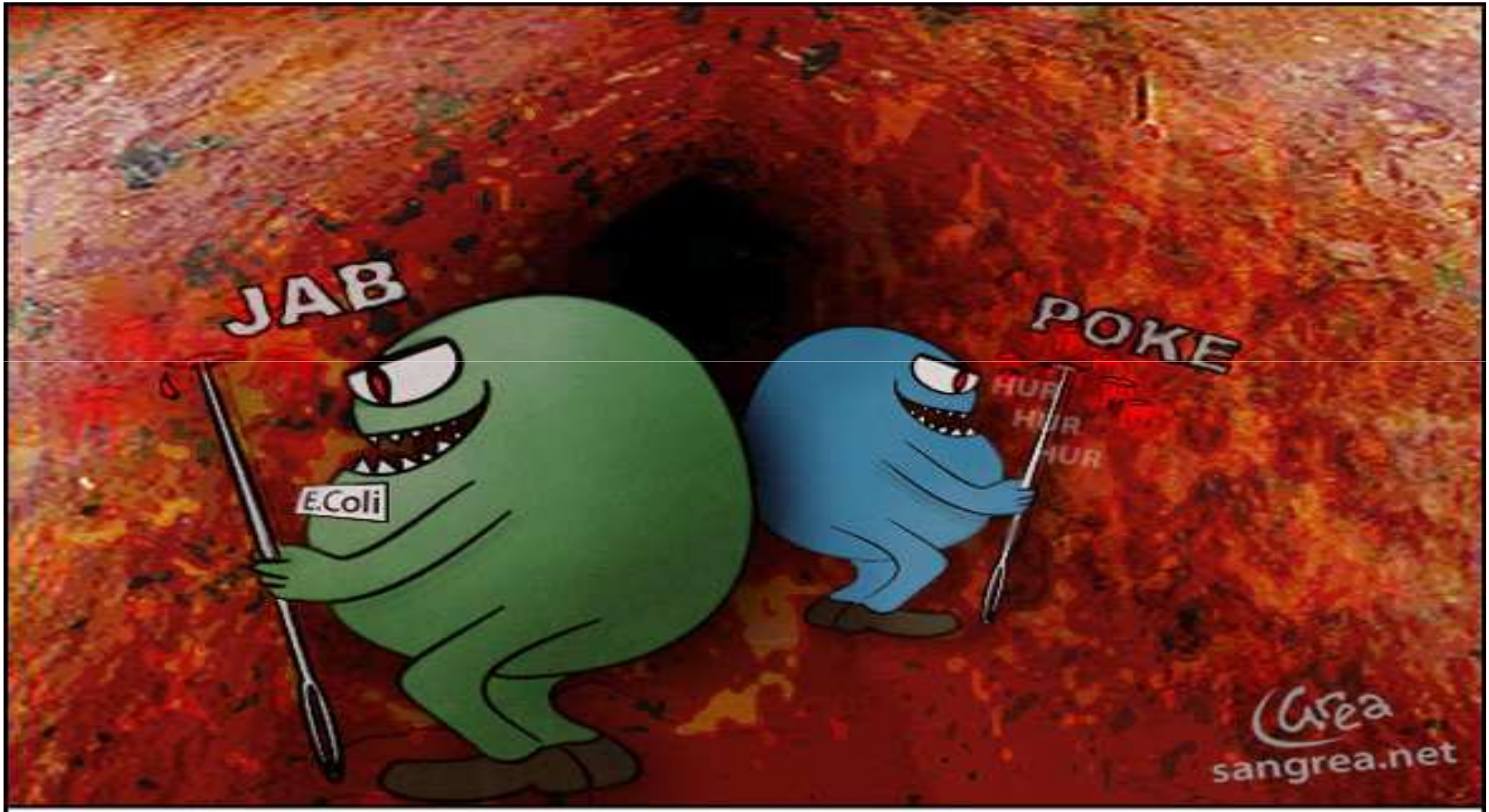
Special condition – tuberculosis of kidney

- Patient presented with frequency, painless hematuria & pyuria
- Urine cultures are negative
- Pyuria without bacteriuria
- Lab diagnosis :
  - 3 consecutive first morning samples
  - Centrifuged & deposit stained with Z-N stain
  - Inoculated on L-J medium after decontamination



Approach to diagnosis of urinary tract infections

THANK YOU



The dreadful truth behind urinary tract infections