Urinary Tract Infections

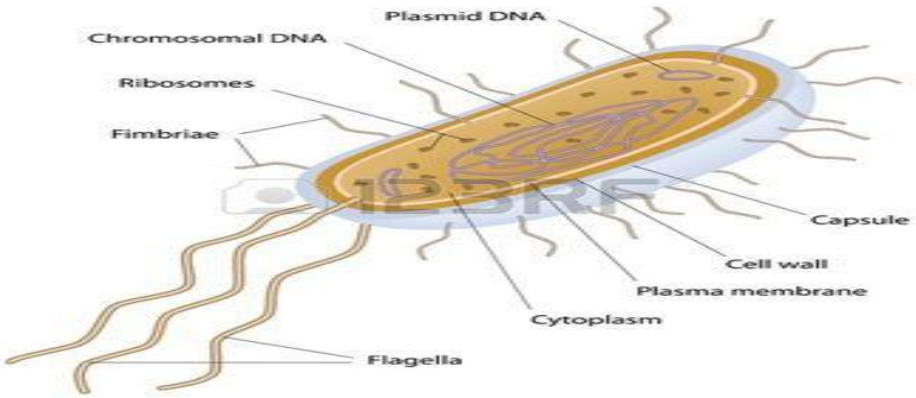
- Sources :urinary_tract_infections-3rd_year-medical_students-_1_2016 (edited+some notes from last year sheet)
- Normal urine is sterile in urinary bladder, It contains fluids, salts, and waste products, but should be free of any microorganism.
- First portion of urine might be contaminated with few resident microorganisms during its passage through urethra .(More in women than Men). (shorter urethra in women)
- Urinary tract infection **(UTI)** occurs often when bacteria from the intestinal tract, contaminate the opening of urethra and begin to ascend & multiply causing inflammation of any part of urinary tract System.
  GI→urethra→ **UTI.**
- **UTI** is defined as a significant **bacteriuria** associated with presence of signs & symptoms or **asymptomatic**
  UTI= bacteriuria +\- symptoms
- **Dysuria** :painful urination including burning, frequent urination , fever, abdominal pain →Due to presence of **Pus cells & Bacteria** in urine , Urinary Stones, Sexually Transmitted infection.
- **Sterile Pyuria:** Presence of only pus cells in urine. → Pyuria without bacteriuria (**Pyuria** :Presence of white blood cells in the urine; symptom of urinary tract infection)
- **Cystitis**: Inflammation of the lower urinary tract **urethra** and **Bladder** mucosa, mostly by bacteria(mostly E.coli; from feces) . This infection is not invasive. It is Frequently associated with voiding frequent small volume urine, can be **mild/severe** associated with fever, burning, abdominal pain, cloudy or bloody urine.
  Rarely can be associated with **septicemia**(in Young children & Immunosuppressed patients).
- **Hemorrhagic cystitis** is characterized by presence large numbers of visible **RBCs** in the urine.
- **Pyelonephritis**: Inflammation of the kidney and its pelvis caused by bacterial infection . Usually results from ascending of the bacteria to the **Ureter** & **Kidney** from the urinary bladder caused by bacterial cells. rarely caused by Candida or viruses.
  Can cause High fever and may result in blood sepsis (→High fever) & kidney failure.
  It can also arise by hematogenous spread (sepsis, pneumonia). In contrast to cystitis.. Pyelonephritis is an invasive disease, With severe consequences.
  Pyelonephritis can arise from infection in UB or from hematogenous spread.
- **Blood Sepsis** may complicate UTI.. Common in children & women, following surgery, compromised patients.. Infection of upper part of UT
- Types of UTI : 1) community UTI ,95% of UTI cases 2) Nosocomial infections 5-15% .
  # Community UTI: 95% of UTI cases.{ causative agent is one of the intestinal flora (Auto infection)}

- 90% of **acute community UTIs** developed in patients with normal anatomic structure and function caused by certain strains of *E. coli (*facultative aerobic bacteria spp. of fecal origin). A number of E.coli strains(uropathogenic E.coli) have attachment factors (factor 1 and 2)and these are responsible for such infections and these constitutes around 10-20 percent of E.coli strains(other strains 80-90 doesn't cause infection).

-10 % →**Coagulase-negative & positive ve *Staphylococcus*** → important cause of infection in young ladies less than 18 years (it's part of skin flora so any change in the PH of the vagina or in association with folly's catheter)
-(5-10%).→other G-ve Klebsilla -Enterobacter group, Proteus or G+ve Enterococci faecalis (Enterococcus in the last 20 years became more imp due to the usage of 2nd and 3rd generations of cephalosporins)

- Nosocomail infection 5-15% . :Hospitalized patients acquired often UT infection with multidrug resistance G-ve bacteria due to presence MDR bacteria in their intestine & Hospital environment & following using Foleys catheter . Common: *P. aeruginosa, Proteus spp., Kelbsiella-Enterobacter group ,Enterococcus* spp.

- E.coli



#UTI's rank second to respiratory infections in general incidence.
The majority of cases seen in outpatients clinics among **Females** (F/M ratio **30:1**). ;
1 -UT in females is more exposed to contamination by the feces
2- the mucosa of the female urethra is more susceptible to infection and more readily infected especially during sexual intercourse. Pregnant ladies might get an asymptomatic UTI

- 90% of all married women have at least one episode of a UTI at some time during their productive years. **Pregnancy** & women sexual activity increase UTIs 10 times, Up to 20 % of young women with acute cystitis develop **Recurrent UTI's.**

- Males develop increasing UTIs after ≥ 50s. mostly due to **prostate gland hypertrophy**..underlying diseases, catheterization, diabetes mellitus, Immunosuppressed conditions

- In children congenital urinary tract abnormalities.

- **kidney stones** can injury urethra or form a blockage→ UTI.

-Almost one third of cases admitted to medical centers are related to urinary tract infection

- -Urinary tract infection and respiratory infection together encompass about fifty percent of cases presented in out-patient clinics

Lab Diagnosis

- **Routine Microscopic Analysis:**

- early morning→ Clean-catch **Midstream Urine** should be collected→ examined within one hour of collection or refrigerated up to ≤ 24h.

- **Symptomatic UTI**→Acute Infection/ Significant Bacteriuria: 100,000 colony-forming units (**10^5CFU/ml)** & numerous WBCs (more than or equal ≥ 10 WBSc /HPF){ White Blood Cells per High Power Field}

- **Hematuria**: Few RBCs in urine of women is not significant, But in men is significant →should be investigated for other diseases.

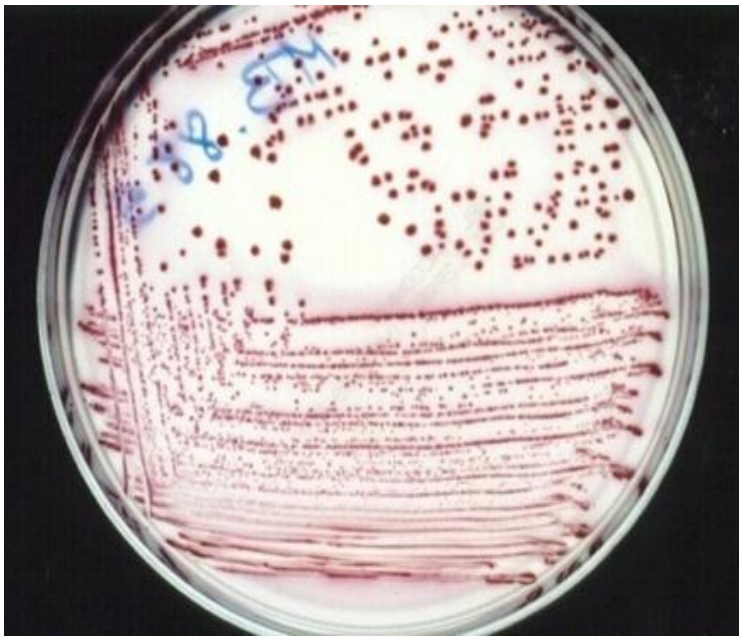
- Presence of few Bacteria /Yeast cells→10-50.000 Cells/ml is part urethral normal flora→**Not significant.**

- **Other important factors**: Color,(normally there is no Protein, no Sugar in urine), pH (acidic 5.5 to 6.5), Casts, Specific gravity etc.
alkaline urine → associated with infection.

-**Asymptomatic** /**Chronic** Infection: 10.000-100,000 CFU/ ml of midstream urine,Few pus cells.
99% Pure Growth of **one** facultative anaerobic bacteria species (Usually the infection is by 1 type of microorganisms)

- Presence 20.000 CFU/ ml or less with absence WBCs→ Mostly not significant.
- Mixed Bacterial Cultures are mostly contamination except in case of obstruction in UT or malignancy .
- Suprapubic Urine :urine directly from urinary bladder (should be sterile),Any pure bacterial count in Infants & young children is significant.
- **Fresh urine samples** should be cultured on **Blood & MacConkey agar** for recovery of both Gram+ve and Gram-ve & Yeast,35-37C Incubation ..24-48 Hrs.

E. coli – Lactose Fermenter
Gram-stain & Culture on MacConkey agar



#Before collecting the samples,pt should clean the external genitalia with only water, dont use alcohol or detergents because it can interfere with the sample.
#We can use a special medium to identify lactose fermintar bacteria .

#Most causative agents needs 24 h to grow in the culture but some need 48 h
We have an Acute , chronic and asymptomatic UTI

In order to get a quantitative culture you need to culture 0.1 ml of urine

- In 99% the UTI is caused by facultative anaerobic bacilli (E.coli) , Rarely caused by candida or anaerobes unless there is an obstruction

#In infants up to 1 year : it's hard to collect urine sample and the only way to get a sample is suprapubic approach and here we don't rely on the count but the presence of ANY microorganism indicates infection because urine is sterile in the UB

Acute UTI:

- Identified by having a large no. of colonies in a culture
- at least 100,000 bacteria/ml with >8 WBCs/phf
- The bacteria most often seen in UTIs are of fecal origin
- 80-90% caused by E.coli
- 2nd most common cause of acute UTI is Coagulase-negative Staphylococcus(incidence increases in married females but the dr didn't say why)
- Other causes like gram –ve(Klebsilla, Enterobacter, Proteus) or gram +ve(Enterococci fecalis) bacteria.

- Klebsilla is the second most common g –ve bacteria after e. coli to cause acute UTI.
- If we find P. aeruginosa in the culture of a patient that developed the infection outside the hospital we assume that the sample was contaminated with it before the culture and we redo the culture.
- if the infection happened inside the hospital, we expect that the patient got infected with the bacteria commonly found in the hospital environment. Infections with multidrug resistant bacteria(P. aeruginosa, Proteus spp., Kelbsiella-Enterobacter spp. Enterococcus sp) is common.(gram +ve(Enterococci fecalis) inf. is more common and staphylococcus inf. is less common inside the hospital than outside).

*Predisposing factors for UTIs:

- pregnancy
- underlying disease
- some antimicrobial drugs
- female gender(female to male ratio= 30:1)
- kidney stones
- congenital abnormalities in the UT.(mainly in children)

Asymptomatic and chronic UTI:

- small no. of colonies
- no. of bacteria ranges from 20,000 to 100,000.
- Asymptomatic has no WBCs and chronic has few WBCs(<8 WBCs/phf)
- In order to say that the patient has chronic or asymptomatic, you must do the culture twice(especially when we have no WBCs) and have the same result in both in order to rule out the possibility of contamination.
- Mixed bacterial culture often indicates contamination except in post surgery patients and patients that have foley's catheter.

Antimicrobial Treatment

- **UTI** clinical manifestations, previous history of infection & antibiotic susceptibility should quid the initial step of usage Antimicrobial Therapy.

#**Community acquired** UT infection /Outpatients

- A febrile(fever) patient experiencing first time uncomplicated symptomatic **Acute cystitis** is usually treated **empirically** for **three days**.
- **First line:** Augumentin, Nitrofurantoin, Cotrimoxazole , Nalidix acid .
- **Second line**: Fluoroquinolones, Norfloxacin/ Ciprofloxacin, 2nd-generation Cephalosporins ,Cefrouxime .
- **Antibiotic prophylaxis** against UTI should be given only in selected clinical cases.

-**Recurrence of UTI's** within 2-3 months →require performing urine culture and antimicrobial susceptibility test.. Often infection associated with Resistant bacterial strains.

#**Hospital acquired** UTI's is often associated **MDR bacteria** →require culture and susceptibility test.

- **Pyelonephritis** is more serious & difficult to cure,may be associated septicemia. Reoccurrence of UTI is due to relapse (treatment failure) or re-infection, mostly with the same bacteria spp.
- **Serious UTI :** Patients experiencing high fever, shaking chills or abdominal pain with symptoms of lower UTI, should be hospitalized and treated with intravenous drugs.

Treatment & Prevention

- A large number of pregnant women develop **asymptomatic bacteriuria**.
- Up to 30% with asymptomatic bacteriuria will develop acute **pyelonephritis** if not treated.
- Treatment of asymptomatic bacteriuria in pregnant women decreases the risk of pyelonephritis, preterm birth & baby with low birth weight.
- Urine samples should be obtained periodically from pregnant women to determine if they have bacteriuria.
- **Asymptomatic bacteriuria** in infants and young children might be observed by crying, abdominal pain or unexplained fever.
- There is no vaccine

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