LECTURE 2&3:
Urinary Tract Infection (UTI)

OBJECTIVE

At the end of the lecture, the student should be able to:

I. Recognize drug induced nephritis
II. Recognize the predisposing factors for infection of the kidney and urinary tract
III. Describe the different types of infection in the kidney and urinary tract
IV. Recognize the clinicopathological features of acute and chronic pyelonephritis
V. Describe the causes of urinary tract obstruction

For more information you can read:

- **Robbins :**

❑ Tubulointerstitial Nephritis: page 533 - 537
❑ Renal Stones: page 545

IMPORTANT

- Some terminologies that you should to know:

Pyelonephritis: ('pyelo' means pelvis,'nephros' means kidney) is an inflammation of the renal parenchyma, calyces, and pelvis

Cystitis: inflammation of urinary bladder.

Ureteritis: Inflammation of ureter.

Urethritis: Inflammation of urethra

Nephrolithiasis: stone in kidney.

Ureterolithiasis: stone in ureter.

Cystolithiasis: stone in urinary bladder

Upper UTI: Include **Pyelonephritis**.

Lower UTI: Includes **Ureteritis**, **Cystitis**, **Urethritis**.

- Introduction: Infection of the urinary tract can cause Tubulointerstitial nephritis (TIN): a group of inflammatory diseases that involves tubules and interstitium*

The causes of Tubulointerstitial nephritis(TIN) dived into three types:

1- Bacterial infection:

Usually Gram negative bacteria

most causes bacteria are in **KEEPS** word

- Klebsiella.
- Enterobacter
- E.Coli (**Most common one**)
- Proteus Vulgaris
- Serratia

2- Hyper sensitivity reaction

- Allergy By certain drugs such as (NSAIDs*, penicillin derivatives like: Methicillin).
- may cause Hypersensitivity type IV or IgE immunocomplex (typeI).

Charcterized by eosinophils and edema.

The nephritis resolves on cessation of exposure

3- Renal transplant:

- When body immune react to reject the transplanted kidney
- It Will be discussed in complete lecture later .

Routes of infection:

I. **Ascending infection:** is the most common route of infection
II. **Hematogenous infection (rare):** by chronic inflammatory diseases, ex: TB or staph. aureus also corona at a later stage .

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* Connective tissue between tubules

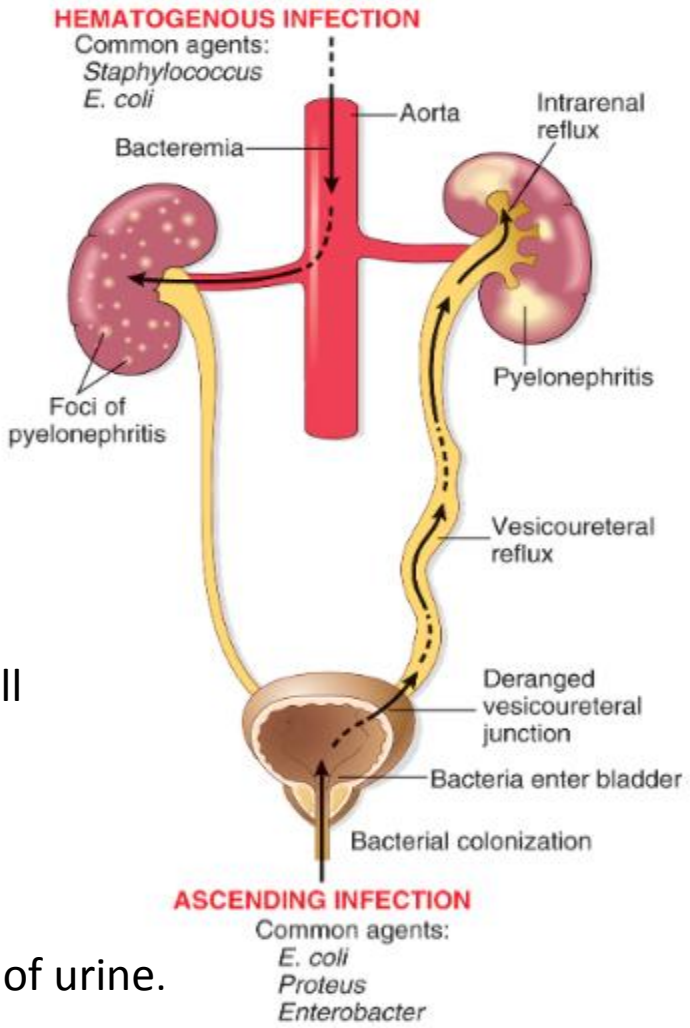
*specially when used it with "diuretics" , this activates both cell mediated (T-cells) and immunocomplex (IgE)

Predisposing factors:

I. **female***.
II. **Obstruction of urethra***.
III. **Any obstructions** (Tumor + Stones + posterior urtheral valve in male infant).
IV. **Vesicoureteral reflux***.
V. **Pregnancy** (Estrogen relax the smooth muscles in the urethra causing stasis which allows bacterial overgrowth).
VI. **Diabetes mellitus**
VII. **Immunosuppression and immunodeficiency**
VIII. **Catheterization**

Signs and symptoms:

I. **Urinary frequency**: a compelling necessity to void small amounts of urine at frequent intervals.
II. **Dysuria**: painful, burning sensation on urination
III. **Pyuria**: large numbers of neutrophils in the urine
IV. **Haematuria**: blood in the urine.
V. **Bacteriuria**: Usually defined as more than 10^5 cfu/ml* of urine.



* Female usually gets infection, because she has shorter urethra and its closer to vaginal & anal opening also due to the way of wiping & cleaning while male rarely gets infection due to longer urethra. If he affected and didn't treated well ,the infection will come back over and over again which will cause a reflux leading to kidney infection and maybe loss of function.

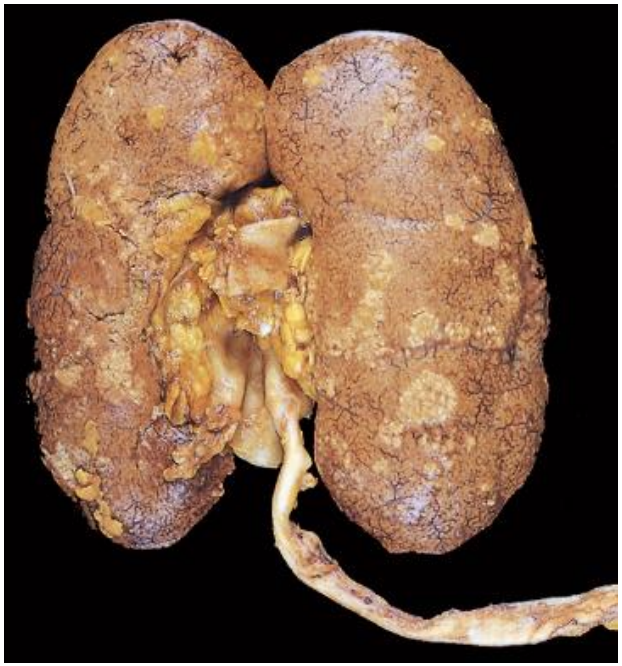
* Benign Prostatic Hypertrophy (BPH) is the most common causes in male

* abnormal movement of urine from the bladder into ureters or kidneys, most common cause in children

* Colony-Forming Units per milliliter

- Acute Pyelonephritis:

Always caused by bacterial infection. Can effect one or both kidney (usually is unilateral).
Characterized by Normal glomeruli, neutrophil infiltration, liquefactive necrosis with abscesses. In the early stages pus formation (suppuration) is limited to the interstitial tissue, but later abscesses rupture into tubules **.**



Clinical Presentation:

Systemic (Fever, chills and malaise)
local (frequency, dysuria and urgency*)leukocytosis, neutrophil cast*

Tests:

Urine test strip or dipstick, radiological tests, urine analysis

complications:

***Necrotizing papillitis**: is an ischemic necrosis of the tips of the renal papillae It is a second form of pyelonephritis caused by: Uncontrolled diabetes mellitus, NSAIDs, Sickle cell anemia

* Sudden, compelling urge to urinate

* Urinary casts are cylindrical structures produced by the kidney and present in the urine in certain disease states. When we see neutrophil casts that mean acute pyelonephritis, but when we see only neutrophil that mean cystitis

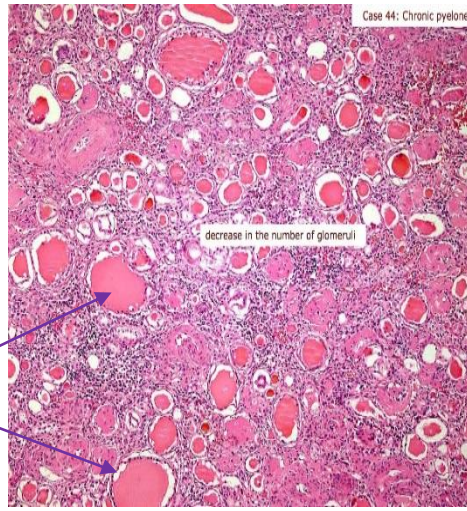
- Chronic Pyelonephritis:

Chronic inflammation with predominant renal scarring deformity of pelvicalyceal system. An important cause of end-stage kidney disease.

One or both kidneys may involved .
When involvement is bilateral , they are not equally damaged.
Divided into two forms:
1) chronic reflux-associated Pyelonephritis: vesicoureteral reflux(urine is going back)
2) Obstructive (renal infection, or other causes of urinary tract obstruction).

Grossly: atrophied kidney and the main thing will be the scar.

Microscopically: chronic inflammation, Atrophic tubules interstitial fibrosis around the granuloma, they become global sclerosis (not work anymore).**In the late stage**, renal tubules will dilate, which contain eosinophilic hyaline casts ''colloid cast''(thyroidization)



- **Cystitis:**

lower UTI, it could be acute or chronic.

- Patient present with hypertrophic bladder (in long standing cases), Frequency, Urgency, Dysuria, Suprapubic pain and Cloudy or foul-smelling urine.

- Women are more likely to develop cystitis
- Tuberculous cystitis is always a sequel to renal TB (rare case)

- **Urolithiasis:** This condition is characterized by the formation of calculi (stones) in the urinary tract, usually in kidney. The incidence is increased in men.

Types:

I. **Calcium stone:** The stones consist of calcium oxalate or calcium phosphate, or both. 80% of renal stones, Not all patients have hypercalcemia, Most patients have hypercalciuria, radiopaque (appear in x-ray)
II. **Magnesium ammonium phosphate (staghorn or struvite) stone:** 8-10%, It forms stag-horn calculi, Formed in alkaline urine, caused by ammonia splitting organisms, (proteus vulgaris or staphylococcus), Radiolucent (Not appear in x-ray).
III. **Uric acid stone:** 2-3%, Associated with hyperuricemia, Radiolucent
IV. **Cystine stones:** Associated with cystinuria or genetically determined aminoaciduria.

MCQs

Q1/ Which of the following is not a common cause of UTI among men?

A. Using a catheter
B. Kidney stone
C. Erectile dysfunction
D. Prostate enlargement

Q2/ What are the signs of UTI?

A. Increased frequency of urination
B. Painful urination
C. Milky/cloudy urine
D. All the above

Q3/ Which of the following is a risk factor for UTI among adults?

A. Diabetes
B. Enlarged prostate
C. Using a catheter
D. All the above

Q4/ The most common causative organism of UTI is?

A. E. Coli
B. Staphylococcus Aurens
C. Streptococcus Pyogenes
D. Bacillus Anthracis

1- C
2- D
3- D
4- A

MCQs

Q5/ A urinary tract infection might involve the?

A. Kidneys
B. Ureter
C. Urinary bladder
D. All the above

Q6/ Urinary tract infections (UTI's) are mainly caused due to?

A. Bacteria spread from the bowel to the urinary tract
B. Old age
C. All the above
D. None of these

Q7/ Who have more risk for kidney stone ?

A. male
B. Women

Q8/ Proteus infection is most likely to lead to what type of stone formation?

A- Uric acid stone
B- struvite stone
C- Cystine stone
D- Xanthine stone

5- D
6- A
7- A
8- B

MCQs

Q9/ Which one have more risk of UTI ??

A. Male , young , healthy
B. Male , old , prostatic hypertrophy
C. Woman , pregnant
D. B+C

Q10/ A 40 years old woman came with dysuria, fever , urine analysis showed neutrophils cast, what is the most likely diagnosis ?

A. Acute pyelonephritis
B. Chronic pyelonephritis
C. Acute cystitis
D. Acute prostatitis

Q11/ women came with sever suprapubic pain , urine analysis showed neutrophils without cast, Cloudy or foul-smelling urine, what is the most likely diagnosis?

A. Acute pyelonephritis
B. Chronic pyelonephritis
C. Acute cystitis
D. Acute prostatitis

Q12/ which one is radiopaque?

A. Ca stone
B. Uric acid stone
C. Cystine stone
D. Struvite stone

9- D
10- A
11- C
12- A

MCQs

Q13/ A patient came with sever flank pain , urine analysis show alkaline urine , and some urea splitting organism . what is the most likely type of stone?

A. Calcium
B. Struvite
C. Uric acid
D. Cystine

14/ old male had osteoarthritis he developed fever and skin rash , the biopsy showed tubular injury and eosinophils infiltrating the interstitial when we took the history we found that he is taking NSAIDs and diuretics, what is the most likely diagnosis ?

A. Drug-Induced Interstitial Nephritis
B. Acute pyelonephritis
C. Acute cystitis

Q15/ A 6 years old child , having recurrent UTI, and he wets his bed a lot, after time he develops hydronephrosis, what is the most likely diagnosis?

A. Vesicoureteral reflux
B. Acute cystitis
C. Acute pyelonephritis

13- B
14- A
15- A

Team Member's

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