LECTURE TWO: PATHOLOGY OF THE INFECTIONS OF THE UPPER AND LOWER URINARY TRACT

BY

DR. AMMAR C. AL-RIKABI, PROFESSOR M.O. ALSOHAIBANI

AND DR. HALA KASSOUF KFOURY

DEPARTMENT OF PATHOLOGY

KING KHALID UNIVERSITY HOSPITAL

URINARY TRACT OBSTRUCTION

A. This obstruction may occur anywhere in the urinary system.

B. In children, the condition is most often due to congenital malformations (associated with reflux or other causes).

C. In adults, the condition is most often acquired and usually occurring as a consequence of renal stones or benign prostatic hyperplasia.

D. **Clinical manifestations** include:

1. Renal colic, which is an excruciating pain caused by acute distention of the ureter, usually due to the transit (movement) of a stone.
2. Hydronephrosis, which is progressive dilation of the renal pelvis and calyces.
3. Infection, which is localized proximal to the site of obstruction and may lead to infection of the renal parenchyma.

INFECTIONS OF THE URINARY TRACT AND KIDNEY (PYELONEPHRITIS AND CYSTITIS)

A. General considerations

1. The incidence of infection of the urinary tract and kidney is greatly increased in women, presumably because of the shorter length of the female urethra and the incidence is increased during pregnancy (because of pressure by the uterus).

2. This condition can be caused by hematogenous bacterial dissemination to the kidney or by external entry of organisms through the urethra into the bladder and in this case infection can spread upward from the bladder into the ureters (vesicounreteral reflux)and through the ureters to the kidney (ascending infection).

3. Most frequently, the infection involves or is caused by the normal flora of the colon, most often Escherichia coli.

B. **Predisposing factors**

1. Obstruction of urinary flow, such as that occurring with urethral obstruction in benign prostatic hyperplasia

2. Surgery on the kidney or urinary tract.

3. Catheters inserted the urethra into the bladder

4. Gynecologic abnormalities

C. **Clinical manifestations**

1. Urinary frequency: a compelling necessity to void small amounts of urine at frequent intervals.

2. Dysuria: painful, burning sensation on urination

3. Pyuria: large numbers of neutrophils in the urine

4. Haematuria: blood in the urine; urinary red cells are a nonspecific finding in urinary tract infection.

5. Bacteriuria: usually defined as more than 10^5 organisms per milliliter of urine: it must be distinguished from contamination of urine specimen by external flora.

D. **Additional diagnostically significant findings in acute pyelonephritis (acute infection of the renal parenchyma).**

1. Fever, leukocytosis, flank tenderness, urinary white cells, and **white** cells casts in the urine (this latter finding is pathognomonic of acute pyelonephritis).

2. Greatly increased frequency in women, especially during pregnancy.

E. **Cystitis: Characteristics include pyuria and often hematuria, but urinary white cell casts are not found.**

TUBULAR AND INTERSTITIAL DISORDERS OF THE KIDNEY

A. **Acute drug-included interstitial nephritis**

1. Most often the trigger is penicillin derivatives, such as methicillin, and other drugs, such as nonsteroidal anti-inflammatory drugs and diuretics.

2. The disease is most likely of immune etiology.

3. Acute interstitial renal inflammation including many eosinophils is characteristic.

4. The nephritis resolves on cessation of exposure to the inciting drug.

B. **Renal papillary necrosis(necrotizing papillitis) is ischemic necrosis of the tips of the renal papillae.**

1. This form of necrosis is most often associated with **diabetes mellitus**, in which it is related to renal infection and coexisting vascular disease. It is occasionally a catastrophic consequence of acute pyelonephritis.

2. Renal papillary necrosis is also associated with long-term persistent abuse of **phenacetin**; most often when phenacetin in is used association with aspirin and other analgesics. This can lead to chronic analgesic nephritis, a chronic inflammatory change characterized by loss and atrophy of tubules and interstitial fibrosis and inflammation. Phenacetin is no longer approved for over-the-counter analgesia preparations (not allowed to be sold by pharmacies without prescriptions).

Chronic pyelonephritis.

1. Coarse, asymmetric corticomedullary scarring and deformity of the renal pelvis and calyces occurs; these findings are essential for the diagnosis.

3. Characteristics include interstitial inflammatory infiltrate in the early stages and later by interstitial fibrosis and tubular atrophy; atrophic tubules often contain eosinophilic proteinaceous casts,resulting in an appearance reminiscent of thyroid follicles (thyroidization of the kidney).

3. Causes almost always include chronic urinary tract obstruction and repeated bouts (attacks) of acute inflammation.

4. Consequences include renal hypertension and end-stage renal disease.

UROLITHIASIS

This condition is characterized by the formation of calculi (stones) in the urinary tract. The incidence is increased in men.

A. **Calcium stones** account for 80% -85% of urinary stones.

1. The stones consist of calcium oxalate or calcium phosphate, or both.

2. They are radiopaque (can be seen by using x-rays).

4. They are associated with hypercalciuria, which is caused by:

a. Increased intestinal absorption of calcium.

b. Increased primary renal excretion of calcium

c. Hypercalcemia, which may be caused by:

(1) Hyperparathyroidism leads to nephrocalcinosis (calcification of the kidney), as well as urolithiasis.

(2) Malignancy leads to hypercalcemia because of osteolytic metastases or ectopic production of parathyroid hormone (often by a squamous cell carcinoma of the lung).

(3) Other causes include sarcoidosis, vitamin D intoxication, and the milk-alkali syndrome.

B. **Ammonium magnesium phosphate stones** are the second most common form of urinary stones.

1. These stones are formed in alkaline urine, which is caused most often by ammonia producing or "splitting" (urease-positive) organisms, such as proteus vulgaris or staphylococcus.

2. They are radiolucent.

3. They can form large staghorn (struvite) calculi (casts of renal pelvis and calyces).

C. **Uric acid stones** are associated with hyperuricemia in approximately half of the patients; hyperuricemia can be secondary to gout or to increased cellular turnover, as in the leukaemias or myeloproliferative syndromes.

D. **Cystine stones** are almost always associated with cystinuria or genetically determined aminoaciduria.