

Diseases of Urinary System

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Learning objectives

By the end of this course; you should know:

- Common diseases involving kidney and urinary bladder
- Clinical presentation of renal diseases
- Morphology of common renal diseases
- Types of glomerulonephritis and their clinical impact
- Main features of nephritic and nephrotic syndromes
- Growth disordered and **TUMOURS** of the kidney, ureter and urinary bladder.

Talks outlines

- **Diseases of the kidney:**
 - Renal anomalies
 - Glomerulonephritis
 - Tubulo-interstitial renal diseases
 - Renal stones
 - Renal tumors
 - Renal failure

- **Diseases of the ureter and urinary bladder**
 - Inflammatory diseases
 - Neoplastic lesions

Renal diseases

Renal calculi

Renal diseases

Renal calculi

Occur due to precipitation of inorganic crystals of the urine.

Etiology/predisposing factors:

1. Increase urine concentration:
hot weather, ↓ water intake

2. Increased inorganic crystals:

- a. ↑ calcium: hyperparathyroidism
- b. Excess urate as in gout
- c. Excess oxalate as in excess intake in diet (tomato, mango)
- d. Excess cystine as familial cystinurea

3. Urine stasis: predispose to infection and help precipitation of inorganic crystals

4. Urinary tract infection

- a. Provide a nucleus for the stone
- b. Change pH of urine: alkaline pH predispose to phosphate stone while acidic pH predispose to oxalate stone

Renal diseases

Renal calculi

Types of renal stones:

	Oxalate	Urate	Phosphate
Type	Primary	Primary	Secondary to infection
Site	Renal calyces, renal pelvis and urinary bladder		
Size	Small	Usually small, may be large	Usually large (stage horn)
Number	Multiple	Single or multiple	Usually single
Color	Black	Yellow/brown	Chalky white
Surface	Spiky	Smooth	Smooth
Consistency	Hard	Hard	Friable
X ray	Radio-opaque	Radiolucent	Radio-opaque

Renal diseases

Renal calculi

Types of renal stones:



Oxalate stone

Urate stone



**Staghorne
phosphate stone**

Renal diseases

Renal calculi

Effects and complications

- **M**igration → pain & obstruction.
- **O**bstuction → hydroureter & hydronephrosis or calculus anuria.
- **H**ematuria due to Injury of urinary mucosa.
- **I**nfection → cystitis → pyelonephritis, pyoureter, pyonephrosis.
- **M**etaplasia (squamous metaplasia) → squamous cell carcinoma..

Renal diseases

Hydronephrosis

Renal diseases

Hydronephrosis

Definition:

A chronic dilatation of renal pelvis and calyces with progressive pressure atrophy of renal cortex.

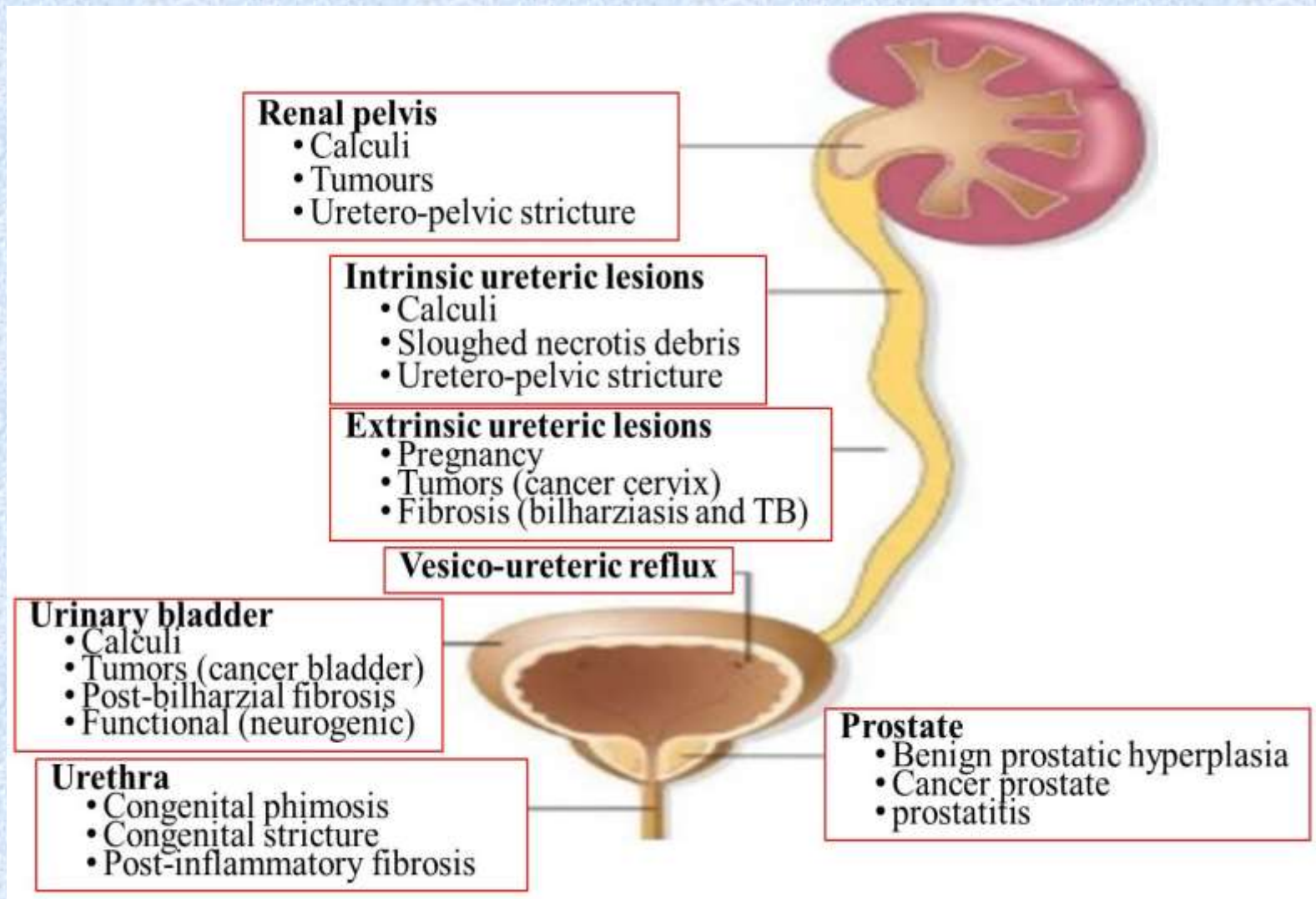
Etiology:

It occurs due to gradual, incomplete or intermittent obstruction of urinary pathway at any level of urine outflow

Renal diseases

Hydronephrosis

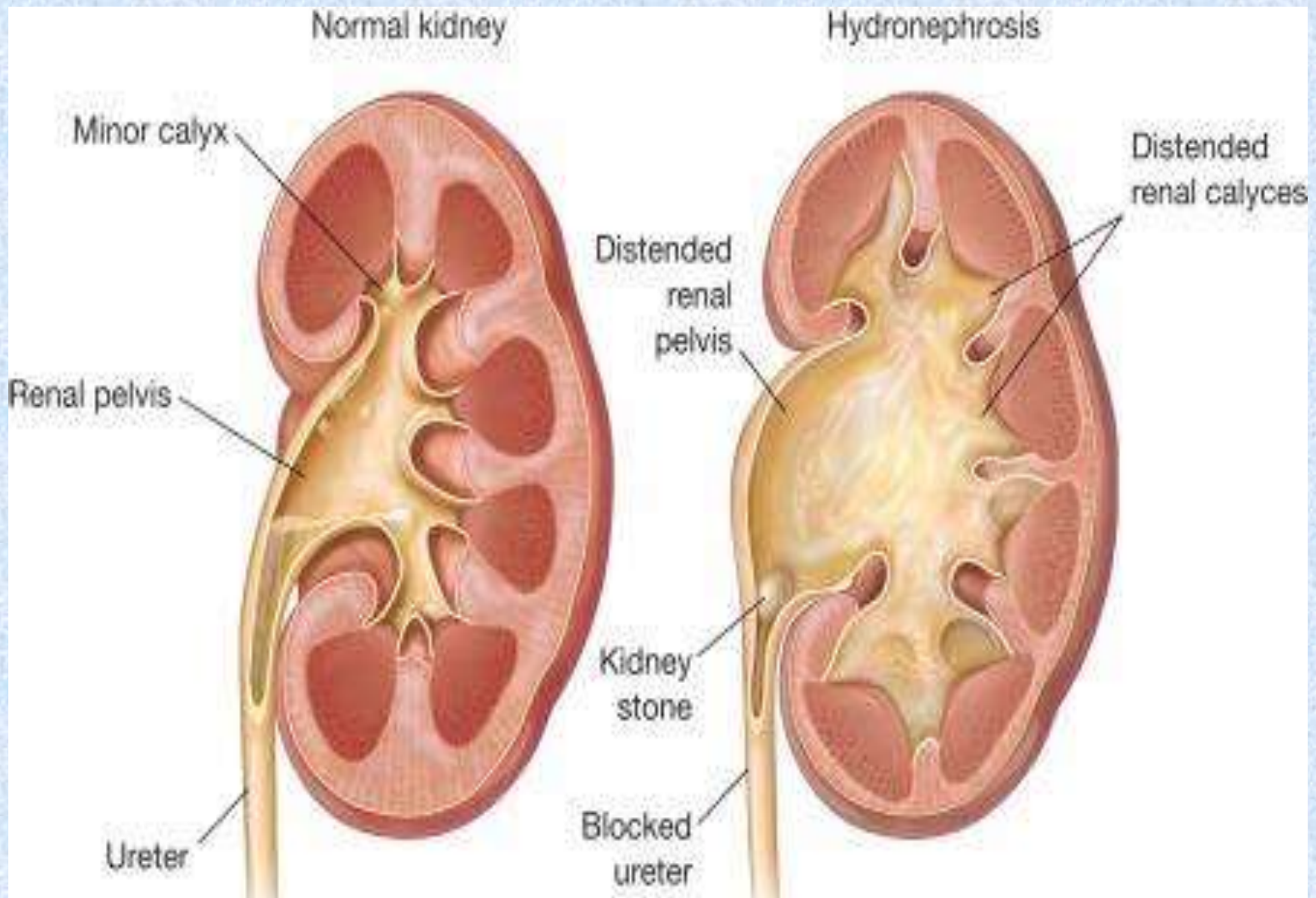
Etiology:



Renal diseases

Hydronephrosis

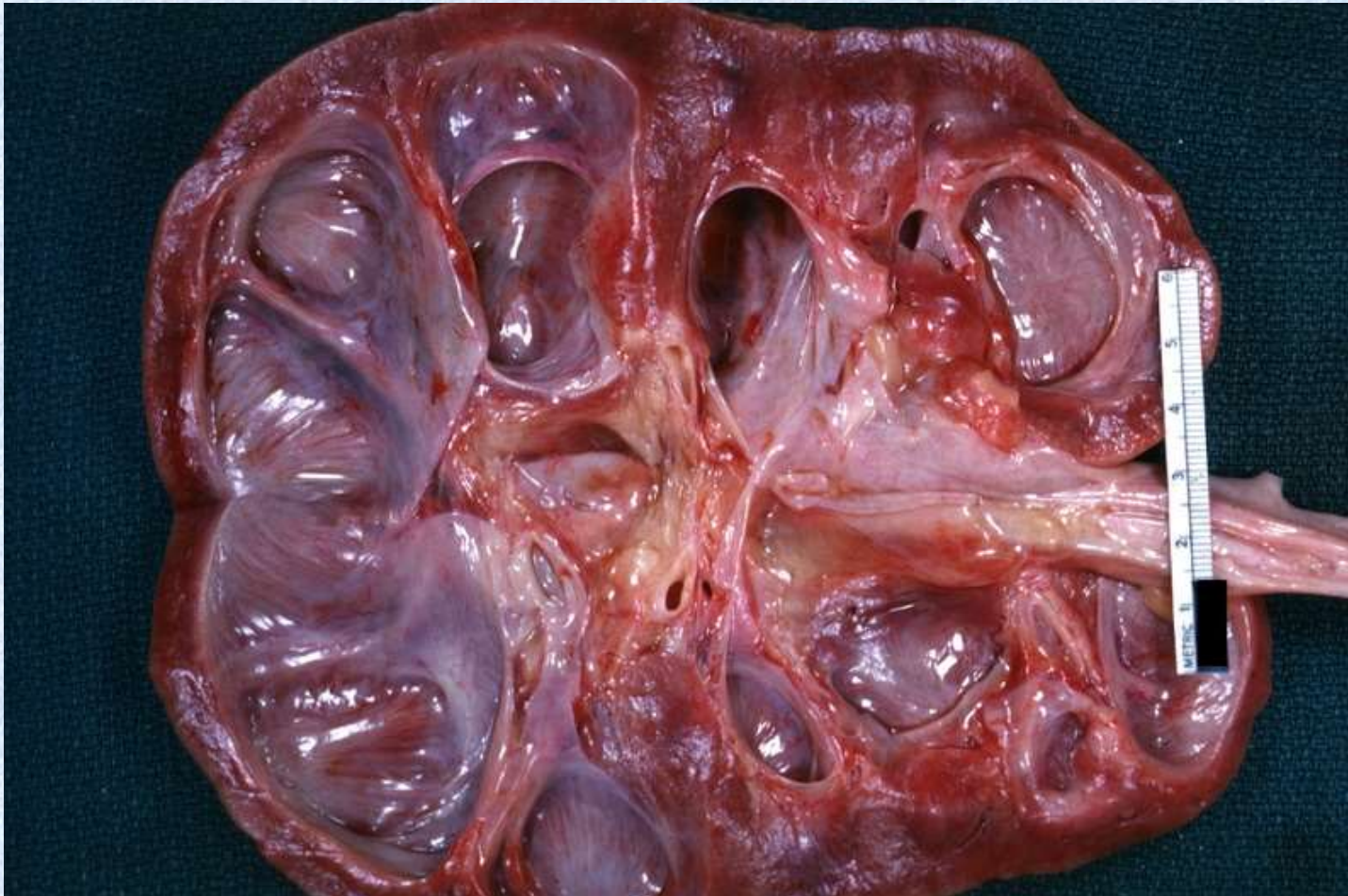
Grossly:



Renal diseases

Hydronephrosis

Grossly:



Renal diseases

Hydronephrosis

Grossly:

In bilateral cases; there is:

- Hypertrophy and dilatation of urinary bladder with trabeculation of the wall.
- Urinary bladder diverticula
- Bilateral hydroureter

- MP:

Atrophic renal cortex with fibrosis

Renal diseases

Hydronephrosis

Complications:

- Secondary infection leading to pyonephrosis
- Hypertension
- Stone formation
- Chronic renal failure (in bilateral cases)
- Urinary bladder diverticula with diverticulitis and stone formation.
- Squamous metaplasia that predispose to carcinoma.

Renal diseases

Tumors of the kidney

Renal diseases


Tumors of the kidney

Classification:

❑ Tumors of the kidney

A. Benign: cortical adenoma, oncocytoma, angiomyolipoma and fibroma.

B. Malignant:

- Primary:  Renal cell carcinoma (hypernephroma)
Wilm`s tumor (Nephroblastoma)

- Secondary: **rare** (direct infiltration from suprarenal gland)

❑ Tumors of renal pelvis

A. Benign: villous papilloma, hemangioma and leiomyoma

B. Malignant: transitional cell carcinoma and squamous cell carcinoma.

Renal diseases

Renal cell carcinoma

Definition:

A malignant epithelial neoplasm arising from lining epithelium of renal tubules.

Incidence:

- The commonest renal tumor of adults
- Usually affects middle to old age (4th-6th decade)
- Male to female ratio: about 2:1

Risk factors:

Genetic:

- Von-Hippel-Lindau syndrome (mutation of a tumor suppressor gene).
- Polycystic kidney (30 folds higher)

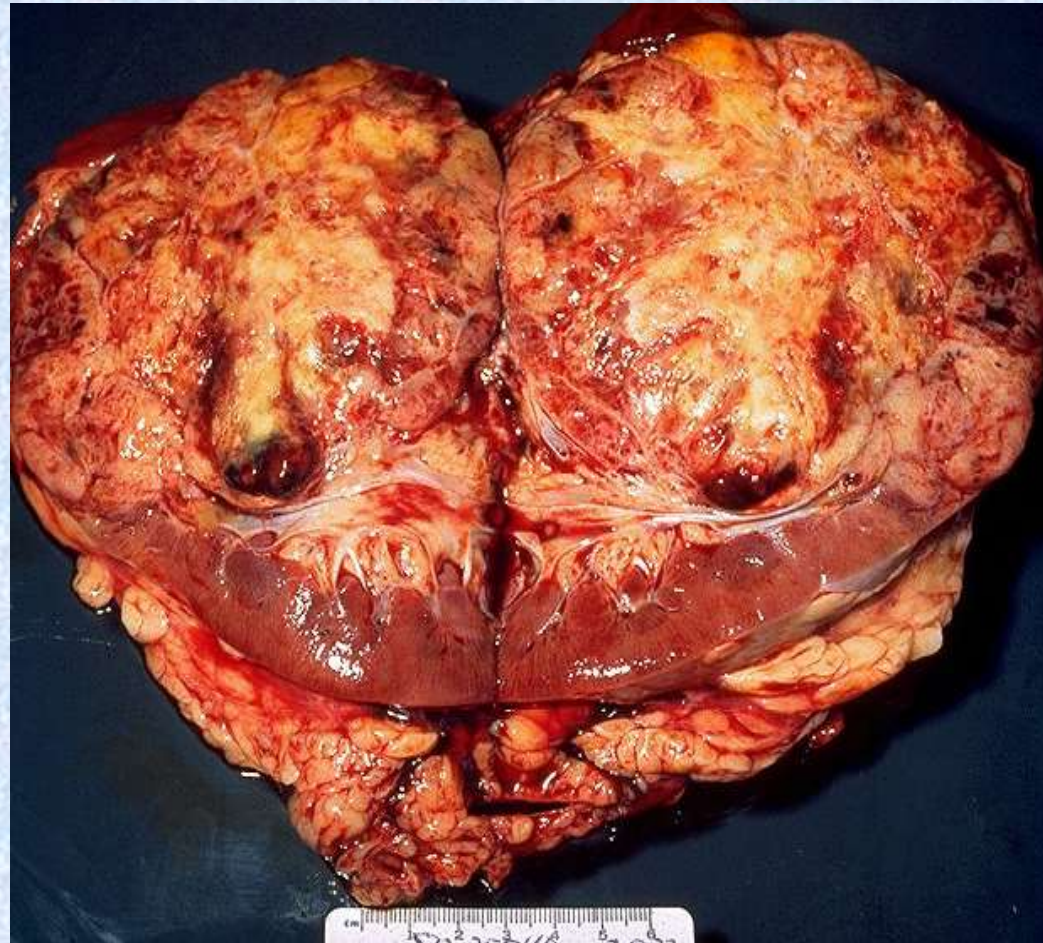
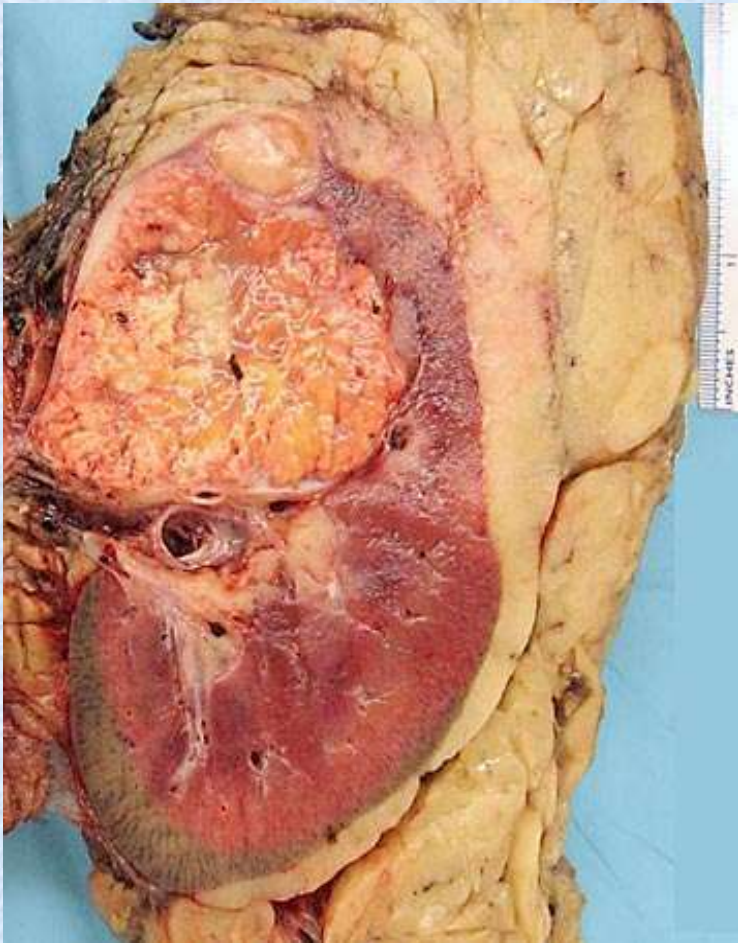
Acquired:

- Renal dialysis
- Smoking

Renal diseases

Renal cell carcinoma

Grossly

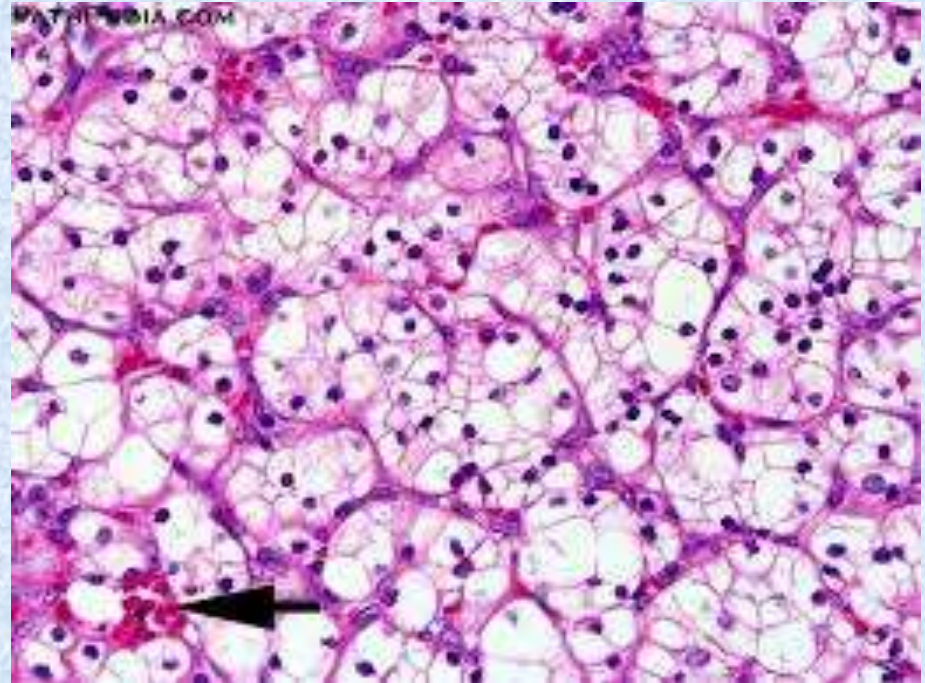
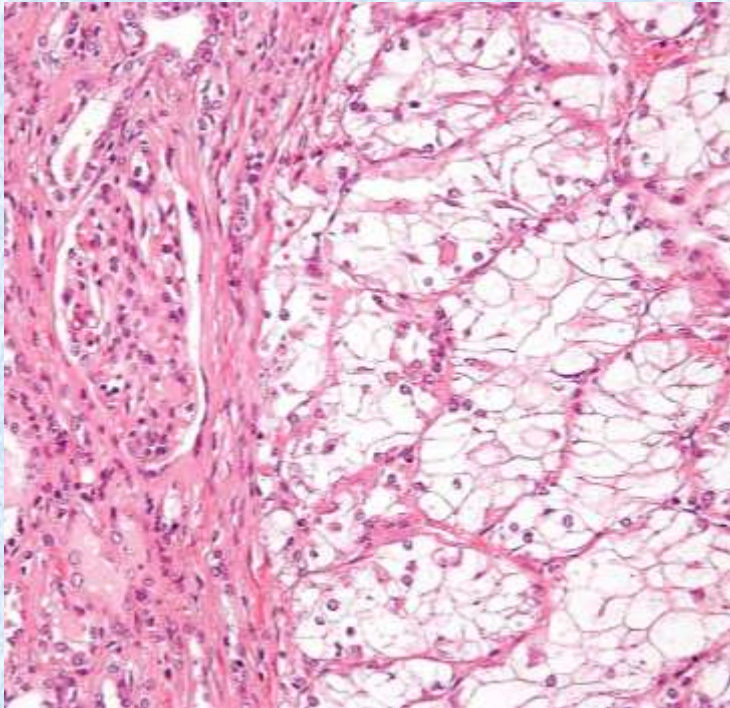


Renal diseases

Renal cell carcinoma

Microscopic types:

Clear cell variant (65%):

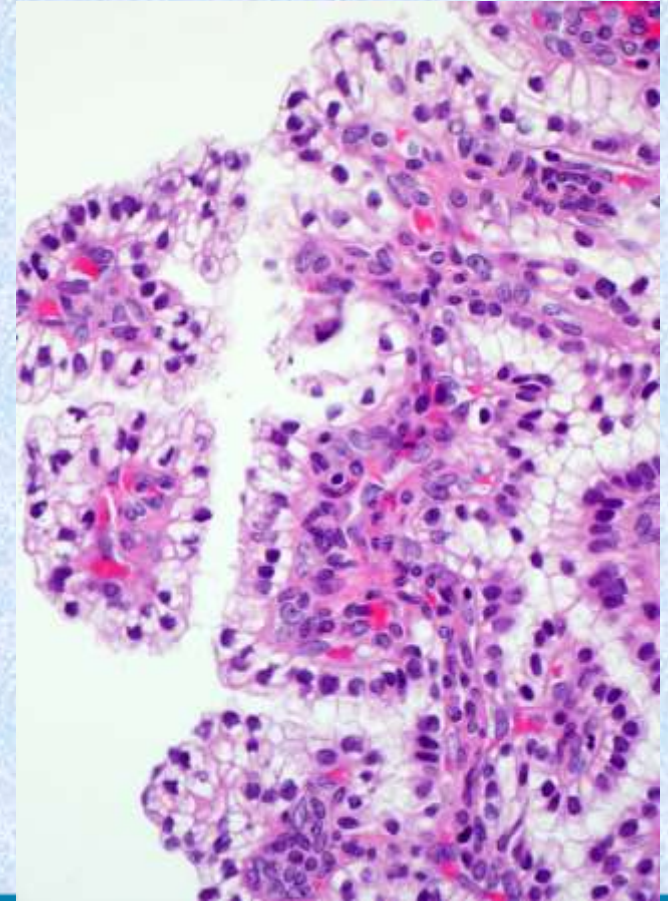
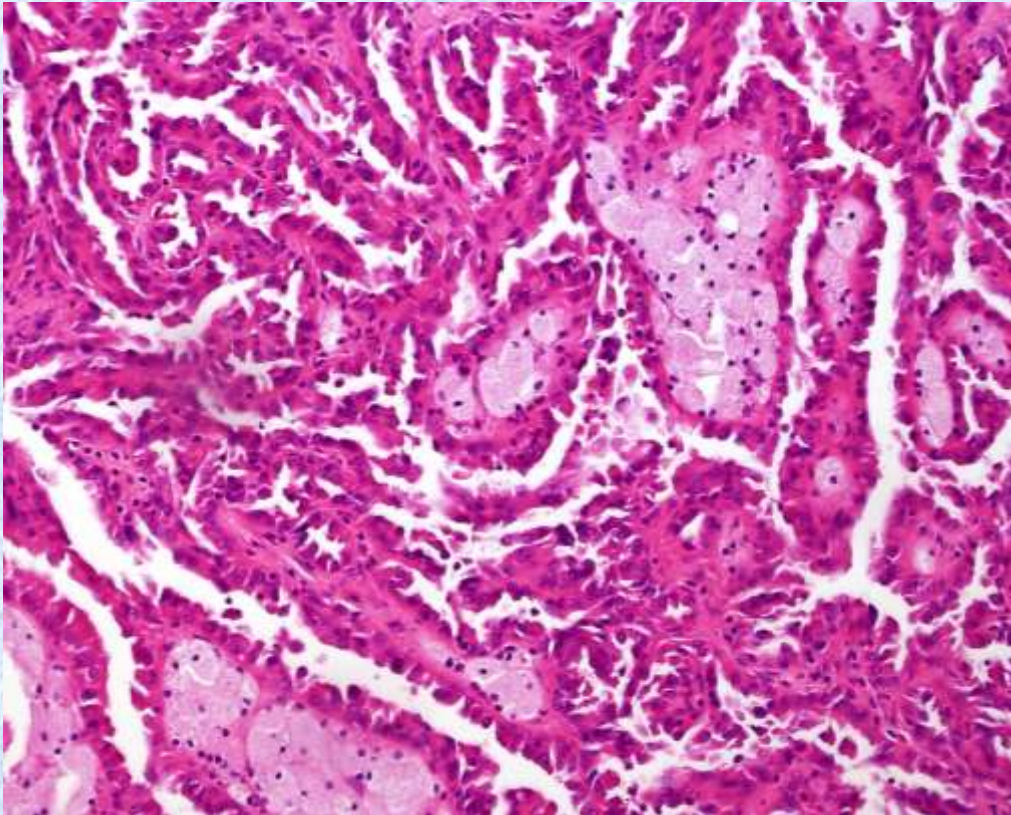


Renal diseases

Renal cell carcinoma

Microscopic types:

Papillary renal cell carcinoma (10-15%):

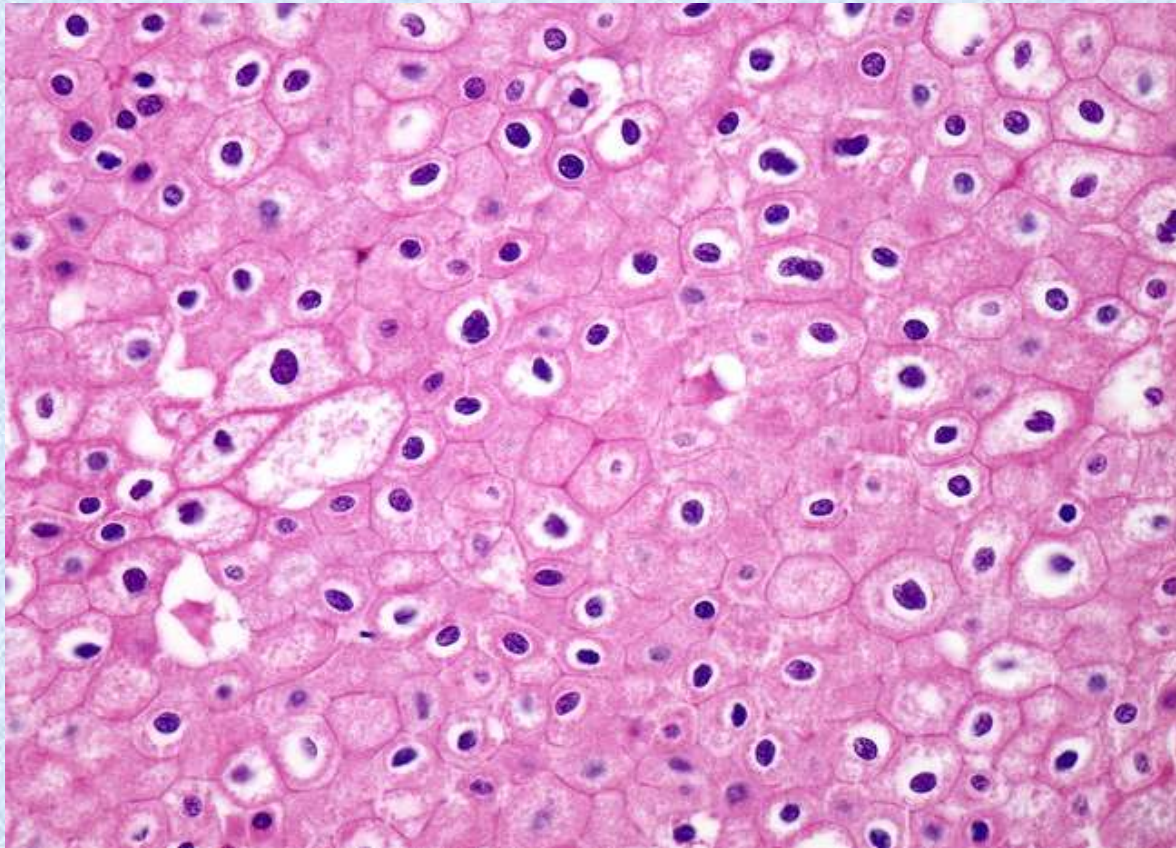


Renal diseases

Renal cell carcinoma

Microscopic types:

Chromophobe renal cell carcinoma (10-15%):



Renal diseases

Renal cell carcinoma

Clinically:

- Hematuria
- Chronic renal pain
- Renal mass
- Anemia, weight loss and fever

Spread

A- Direct: to peri-renal fat, renal pelvis, renal hilum renal vessels and suprarenal gland. Involving left renal vein leads to left testicular varicocele

B- Blood spread (common): to lung, bone and CNS. RCC is one of occult tumors

C- Lymphatic spread: to lumbar and iliac LNs

Renal diseases

Nephroblastoma (Wilm`s tumor)

Incidence

- The commonest embryonic tumors (blastomas) of children
- Cell of origin: embryonic precursor cells.
- Age: most cases occur between 2-5 years.
- Usually unilateral; but could be rarely bilateral.

Grossly

- Usually a large renal mass replacing of most renal tissue
- Fleishy bulging cut section with grayish white or pink color
- Cysts, hemorrhage and necrosis are common
- May infiltrate renal capsule and rarely involve renal hilum or renal pelvis.

Renal diseases

Nephroblastoma (Wilm's tumor)

Grossly



Renal diseases

Nephroblastoma (Wilm`s tumor)

MP

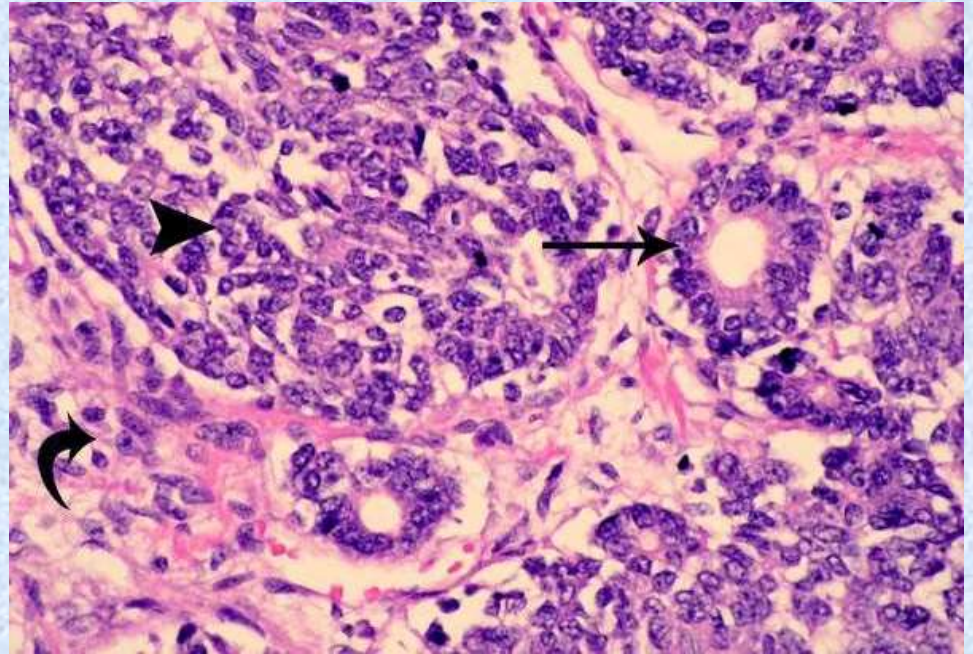
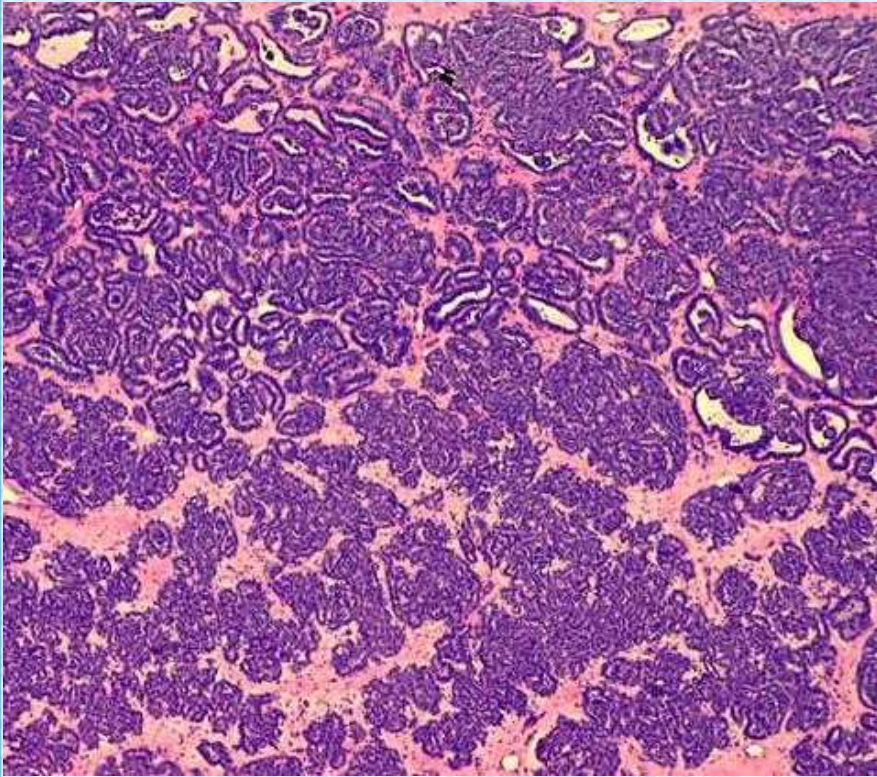
Three histological components (**triphasic**)

- Epithelial: malignant cells arranged in tubular structures, sheets or nests
- Mesenchymal: atypical spindle cell proliferation, muscle or cartilaginous tissue
- Blastemal/undifferentiated: cellular areas, small round or oval cells with scanty cytoplasm and hyperchromatic nuclei
- Dominance of one element may occur.

Renal diseases

Nephroblastoma (Wilm's tumor)

MP



Renal diseases

Nephroblastoma (Wilm`s tumor)

Clinically:

- Renal mass (usually a large abdominal mass)
- Hematuria
- Loin pain

Spread

A- Direct: to peri-renal fat or suprarenal gland less commonly to renal hilum or renal vessels.

B- Blood spread (common): to lung, bone and CNS.

C- Lymphatic spread: to iliac LNs

Renal diseases

**Renal failure
(Uremia)**

Renal diseases

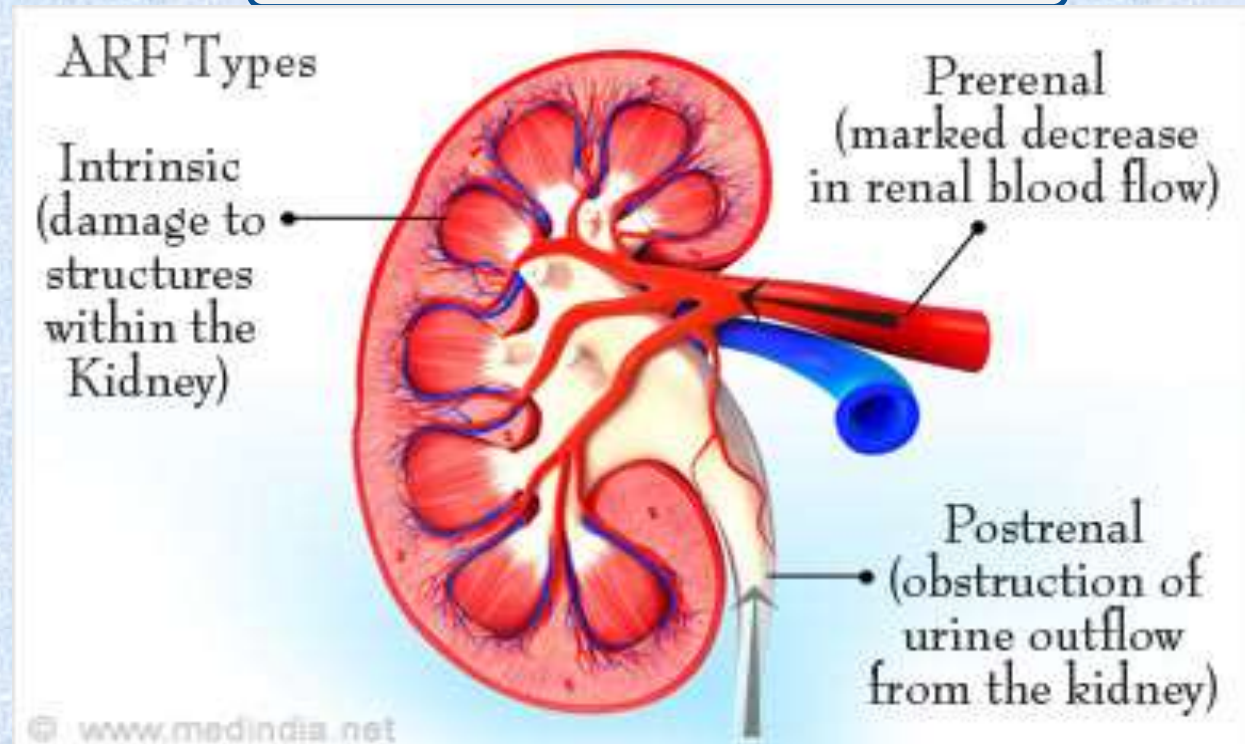
Renal failure

Definition:

Failure of the kidney to perform its function; mainly elimination of waste metabolic products

Etiology

Acute renal failure



Renal diseases

Renal failure

Definition:

Failure of the kidney to perform its function; mainly elimination of waste metabolic products

Etiology

Acute renal failure

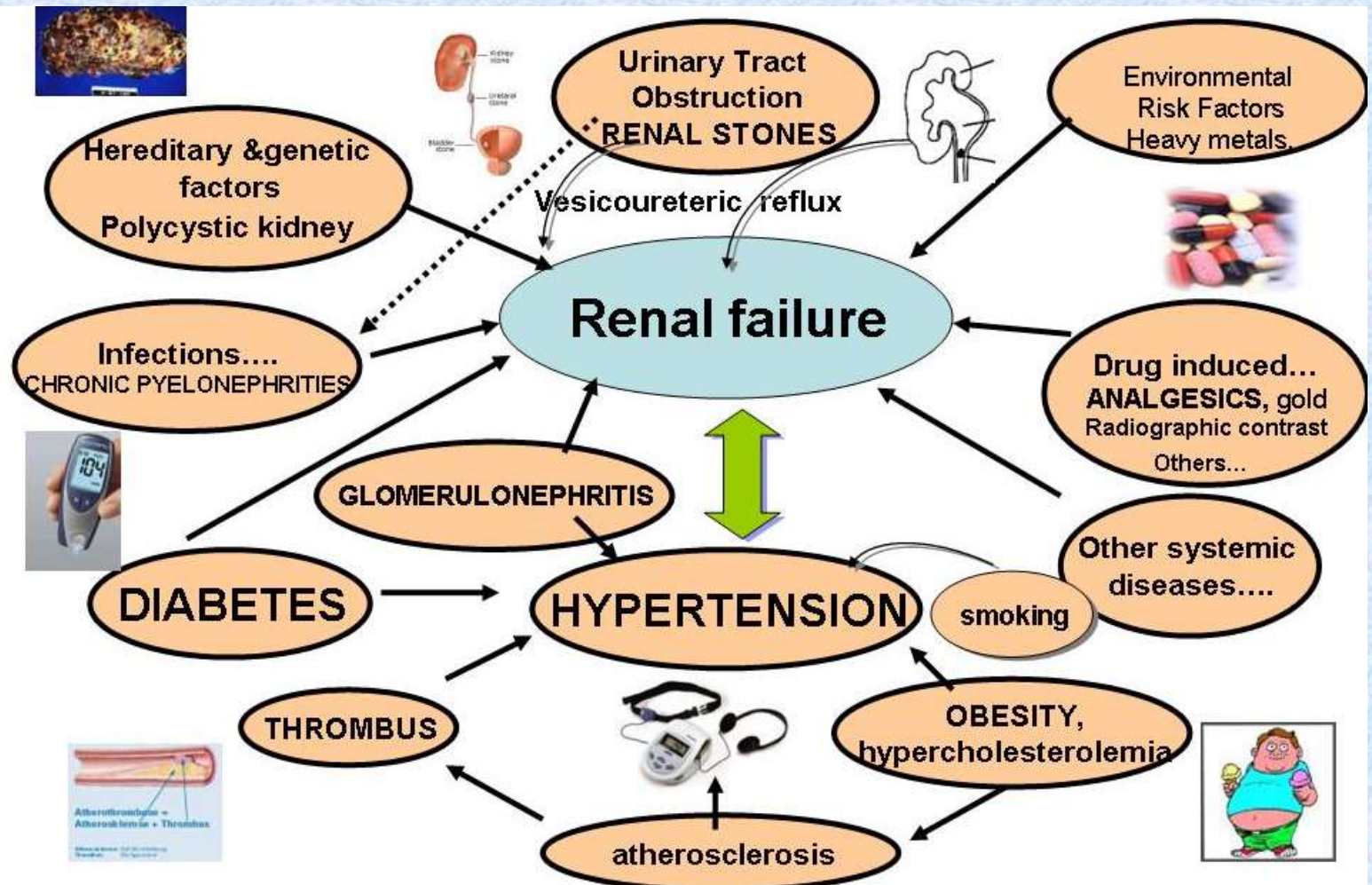
- ① **Prerenal**
Sudden and severe drop in blood pressure (shock) or interruption of blood flow to the kidneys from severe injury or illness
- ② **Intrarenal**
Direct damage to the kidneys by inflammation, toxins, drugs, infection, or reduced blood supply
- ③ **Postrenal**
Sudden obstruction of urine flow due to enlarged prostate, kidney stones, bladder tumor, or injury

Renal diseases

Renal failure

Chronic renal failure

Etiology



Renal diseases

Renal failure

Chronic renal failure

Etiology

- **Glomerulopathies**

Primary glomerular diseases:

1. Focal and segmental glomerulosclerosis(FSGS)
2. Membranoproliferative glomerulonephritis(MPGN)
3. IgA nephropathy(IgAN)
4. Membranous nephropathy(MN)_____

Secondary glomerular diseases:

- 1.Diabetic nephropathy
- 2.Lupus nephropathy
3. Post-infectious glomerulonephritis
4. Amyloidosis
- 5.HIV-associated nephropathy
- 6.Collagen-vascular diseases
- 7.Sickle cell nephropathy
8. HIV associated membranoproliferative glomerulonephritis

- **Tubulointerstitial nephritis**

- Drug hypersensitivity
- Heavy metals
- Analgesic nephropathy
- Reflux/chronic pyelonephritis
- Idiopathic

- **Hereditary diseases**

- Polycystic kidney disease
- Medullary cystic disease
- Alport's syndrome

- **Obstructive nephropathies**

- Prostatic disease
- Nephrolithiasis
- Retroperitoneal fibrosis/tumor
- Congenital

- **Vascular diseases**

17. Hypertensive nephrosclerosis
18. Renal artery stenosis

Renal diseases

Renal failure

Effects



The illustration shows an elderly woman with grey hair, wearing a green polka-dot dress, leaning on a wooden cane. She is holding a yellow clipboard with a grid containing 'X' marks. She has a pained expression, and several red lines radiate from her head, indicating a headache.

- Headaches
- ↓ Ability to Concentrate Urine
- Polyuria → Oliguria
- ↑ BUN & Serum Creatinine
- Edema
- GFR - progressively decreases from 90 to 30 ml/min
- Mild Anemia
- ↑ Serum K
- ↑ BP
- Weakness & Fatigue

DISEASES OF URINARY BLADDER

Diseases of urinary bladder

Cystitis

- **Definition:**

Inflammation of the urinary bladder

- **Etiology:**

- Predisposing factors:*

1. Urine stasis as in enlarged prostate
2. Urinary bilharziasis: unhealthy mucosa
3. Females are more susceptible due to short urethra.
4. Decreased immunity: DM, use of steroids or immunosuppressive drugs and AIDS
5. Urinary tract obstruction: renal calculi, tumors and stricture
6. Urinary instrumentation
7. Nearby infection as pyelonephritis, prostatitis, inflammation of uterine cervix, vagina and urethra

Diseases of urinary bladder

Cystitis

■ Etiology:

Routs of infection:

- Ascending infection through urethra
- Spread from a nearby organ

Causative organism

- Commonly E coli
- Other organisms: Bacillus proteus, klebsiella, staph aureus, streptococci, gonococci and others

■ Pathological features:

- Main two forms: acute and chronic

Diseases of urinary bladder

Cystitis

	Acute	Chronic
<u>Clinically</u>	<ul style="list-style-type: none">-Frequency-Burning micturition-High grade fever & rigors-Hematuria and pyuria-Urine analysis: pus cells and increased RBCs	<ul style="list-style-type: none">-Frequency (less compared to acute form)-Mild and microscopic hematuria-Urine analysis pus cells and RBCs
<u>Pathology</u>	<ul style="list-style-type: none">-Congested submucosa-Infiltration by acute inflammatory cells-Hgcic inflammation in severe cases	<ul style="list-style-type: none">-Benign urothelial changes (mention)-Infiltration by chronic inflammatory cells-Background of fibrosis

Diseases of urinary bladder

Cystitis

Complications:

- Hematuria
- Spread of infection; leading to urethritis and pyelonephritis
- Hematogenous spread: bacteremia, septicemia and toxemia
- Stone formation
- Fibrosis of the urinary bladder (contracted bladder)

Chronic specific cystitis

- Bilharzial cystitis (*see general pathology*)
- Chronic interstitial cystitis
- Chronic polypoid cystitis: polypoid hyperplasia of urothelium with nodular appearance
- Malakoplakia: inflammation rich in histiocytes

Tumors of urinary bladder

Diseases of urinary bladder

Tumors of urinary bladder

■ Benign:

- Epithelial:
- Villous papilloma
 - Inverted papilloma

Mesenchymal: leiomyoma, fibroma and angioma

■ Malignant:

Primary:

- Epithelial
 - 1. Transitional cell carcinoma
 - 2. Squamous cell carcinoma
 - 3. Adenocarcinoma
- Mesenchymal: leiomyosarcoma, RMS (sarcoma botryoides)

Secondary:

- Direct from nearby tumors (prostate, cervix, rectum).
- Trans-luminal (from kidney, ureter and renal pelvic tumors)

Diseases of urinary bladder

Tumors of urinary bladder

■ Recent classification of epithelial tumors of UB:

Urothelial tumors:

- 1.Flat urothelial carcinoma (in situ)
- 2.Non papillary (invasive) urothelial carcinoma
- 3.Papillary lesions
 - Transitional cell papilloma
 - Inverted papilloma
 - PUNUMP
 - Low grade papillary urothelial carcinoma
 - High grade papillary urothelial carcinoma

- Squamous tumors:
- Squamous cell papilloma
 - Non invasive squamous cell carcinoma
 - Invasive squamous cell carcinoma

- Glandular tumors:
- Villous or tubular adenoma (rare)
 - Adenocarcinoma

Diseases of urinary bladder

Tumors of urinary bladder

▪ Risk factors:

- ❑ Urinary bilharziasis: leads to
 - Chronic irritation of the mucosa
 - Tryptophan metabolite has a carcinogenic effect
 - Squamous metaplasia and cystitis glandularis
- ❑ Aniline dyes: used in dye industries
- ❑ Chronic irritation by renal stones or chronic cystitis
- ❑ Smoking

Diseases of urinary bladder

Transitional cell carcinoma

Definition:

A malignant epithelial neoplasm arising from urothelium

Incidence:

- The commonest histological type
- More common in males
- Older age (over 50 years)

Sites:

May arise from urothelial lining of

- Urinary bladder
- Ureter
- Renal pelvis
- urethra

Diseases of urinary bladder

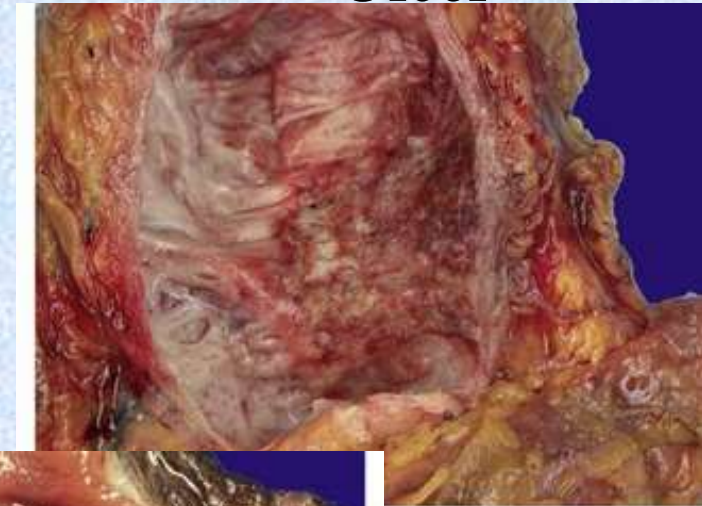
Transitional cell carcinoma

Pathology:

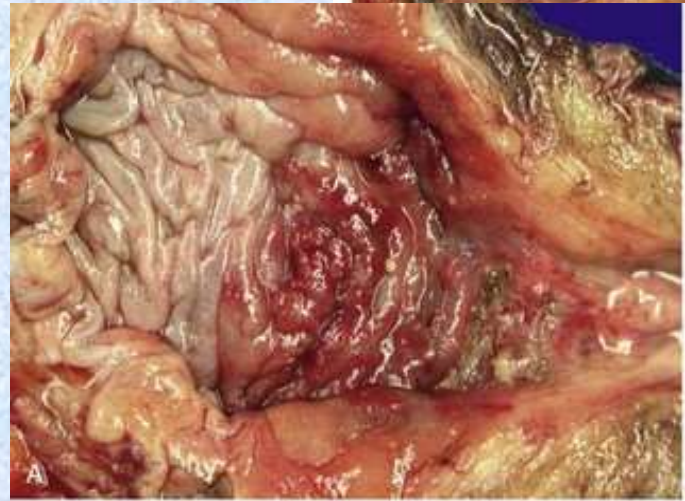
Grossly: 1-Early cases (flat carcinoma)



Leukoplakic patch



Ulcer



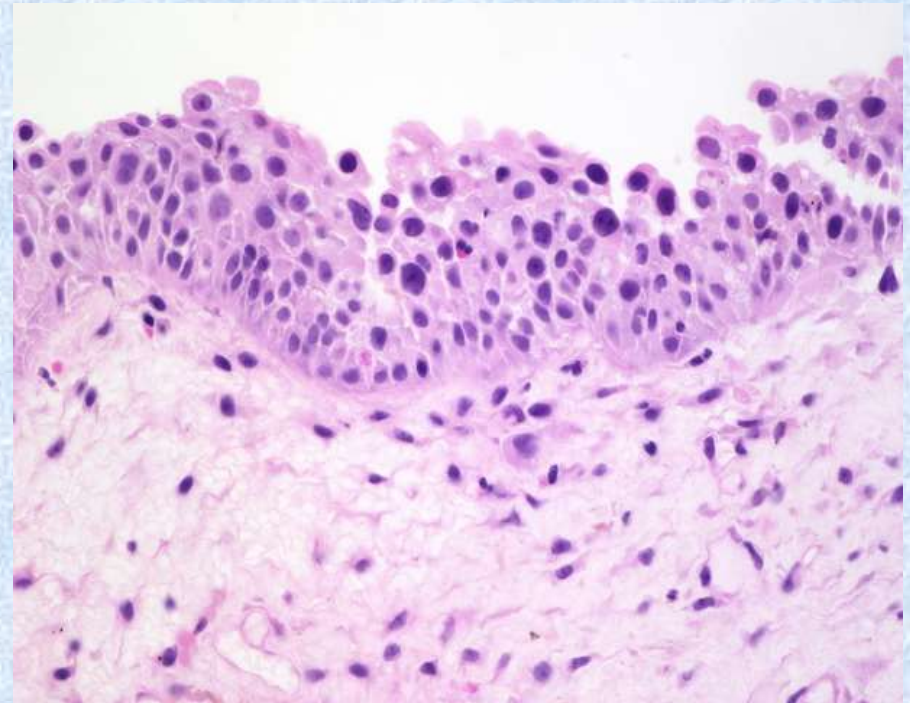
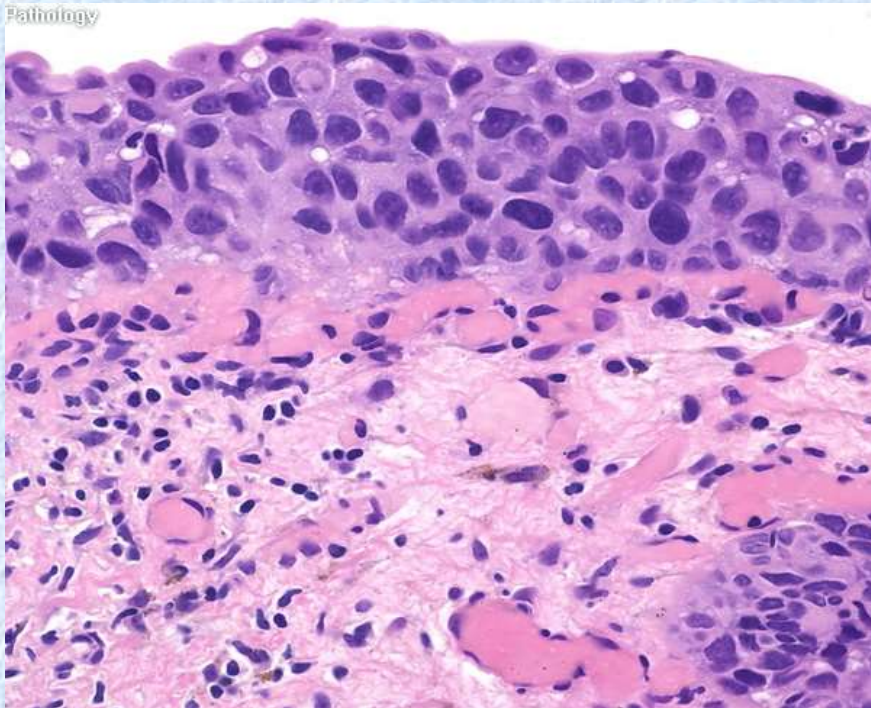
Erosion

Diseases of urinary bladder

Transitional cell carcinoma

Pathology:

MP: 1-Early cases (flat carcinoma)

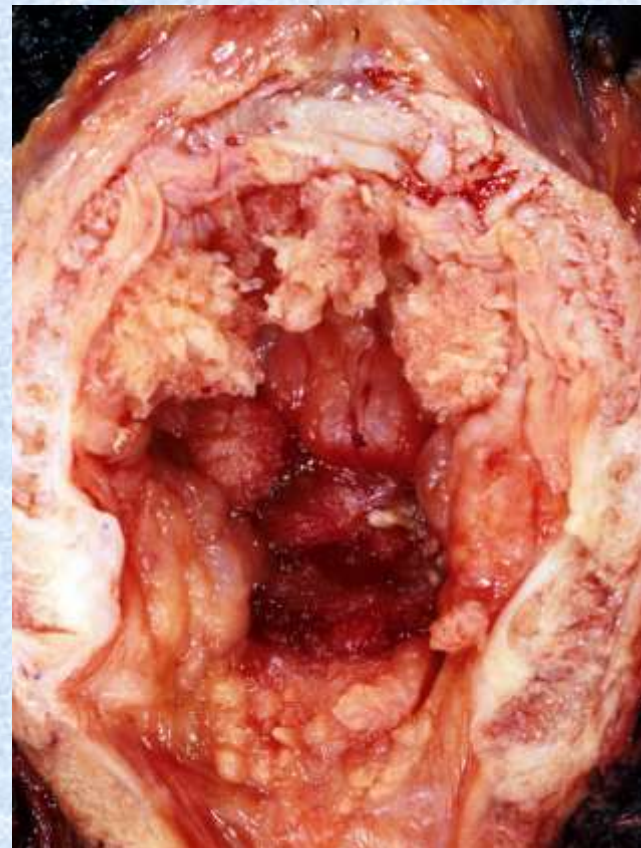


Diseases of urinary bladder

Transitional cell carcinoma

Pathology:

Grossly: 2-Papillary mass

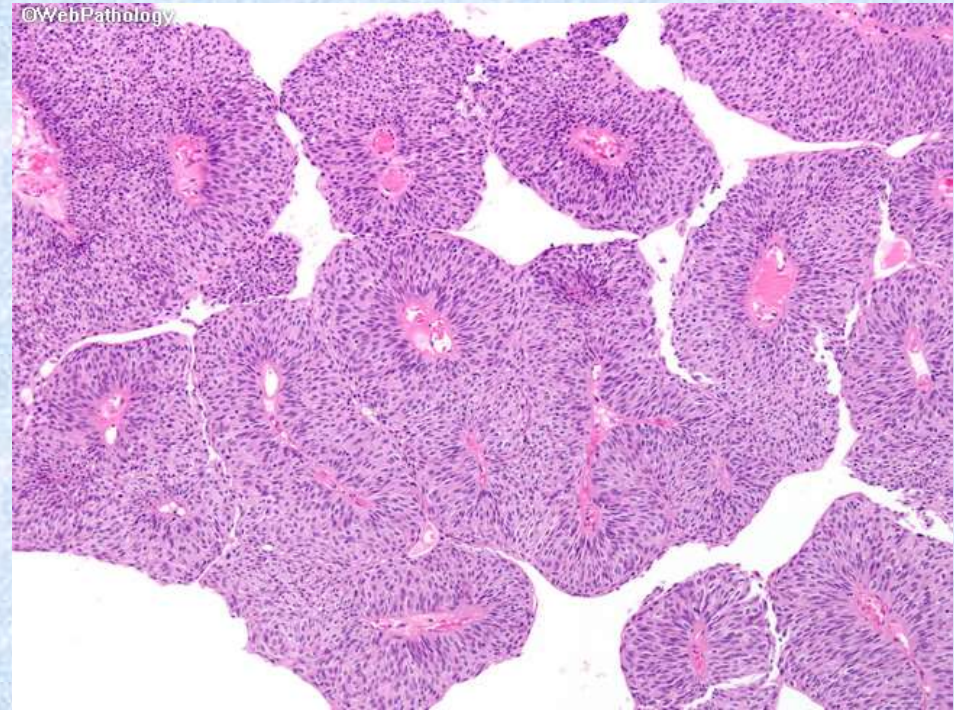


Diseases of urinary bladder

Transitional cell carcinoma

Pathology:

MP: 2-Papillary mass: complex branching papilla

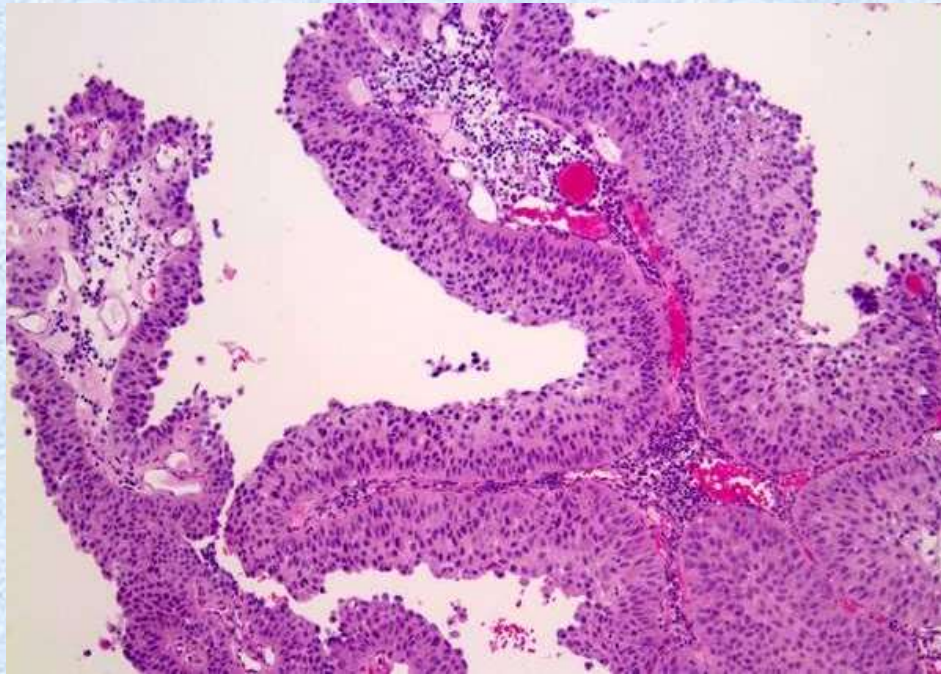


Diseases of urinary bladder

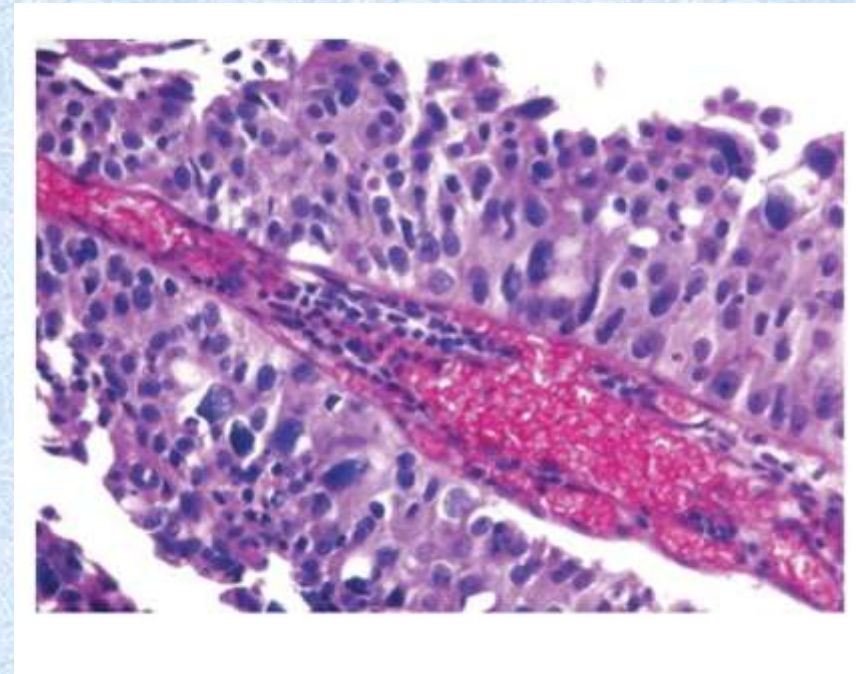
Transitional cell carcinoma

Pathology:

MP: 2-Papillary mass: complex branching papilla



Low grade



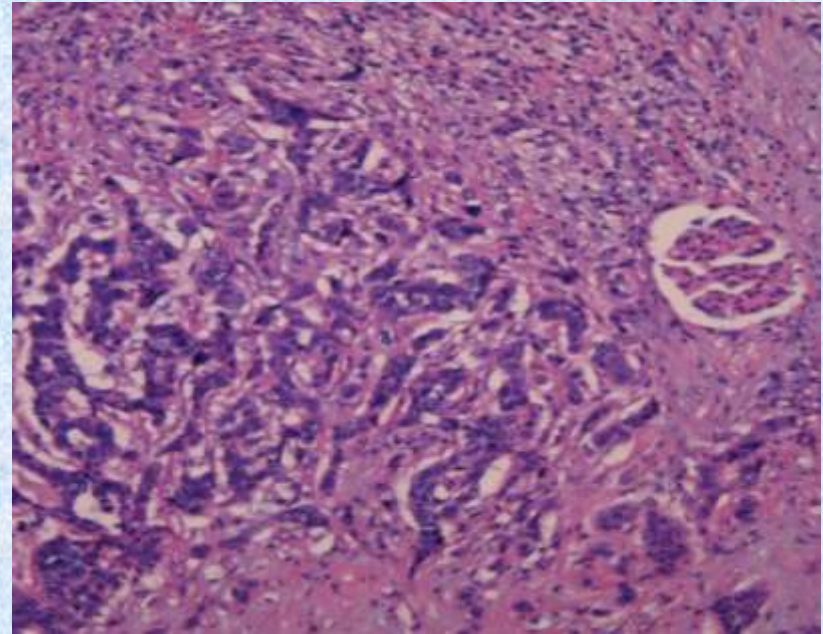
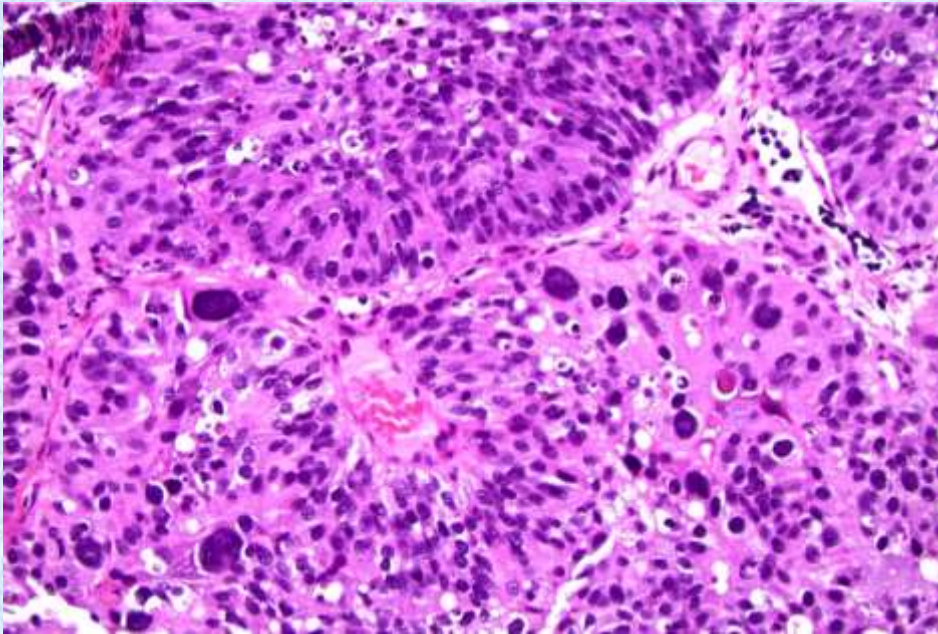
High grade

Diseases of urinary bladder

Transitional cell carcinoma

Pathology:

MP: 3-Invasive urothelial carcinoma: tumor cells infiltrate submucosa forming nests, sheets and cords



Diseases of urinary bladder

Squamous cell carcinoma

Definition:

A malignant epithelial neoplasm arising after squamous metaplasia of urothelium

Incidence:

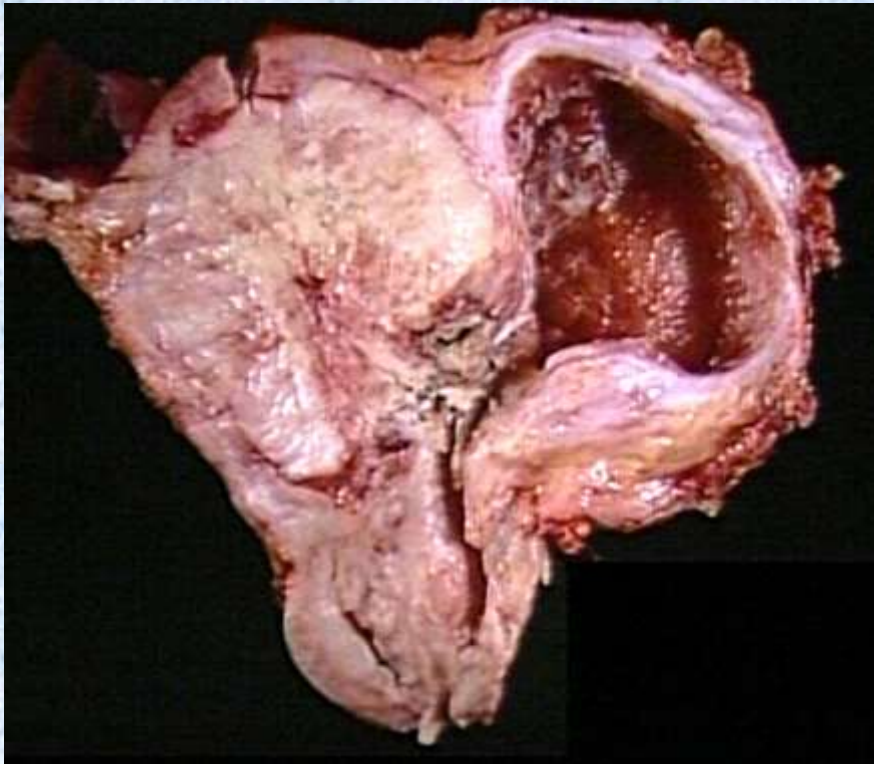
- Worldwide; it is much less common than urothelial carcinoma
- In Egypt is common due to high prevalence of bilharziasis
- More common in males
- Usually affect young adults (30-50 years)

Diseases of urinary bladder

Squamous cell carcinoma

Pathology:

Gross:



Fungating mass



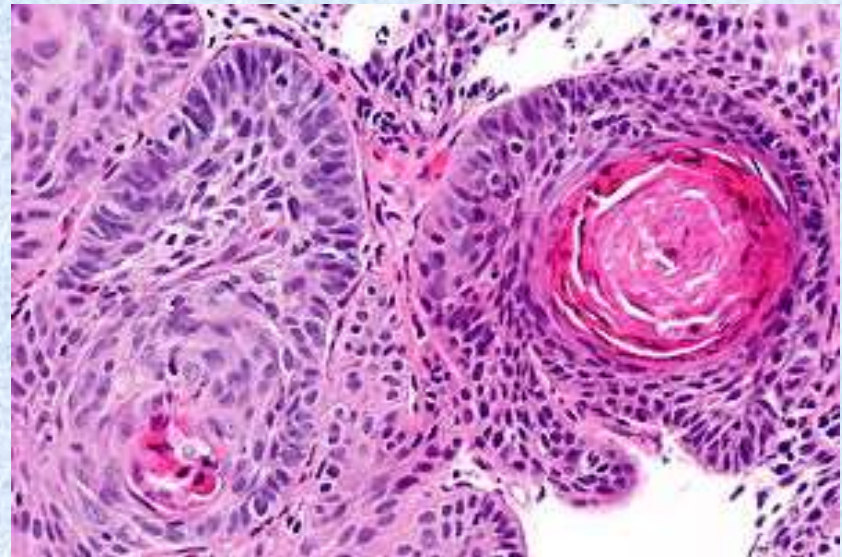
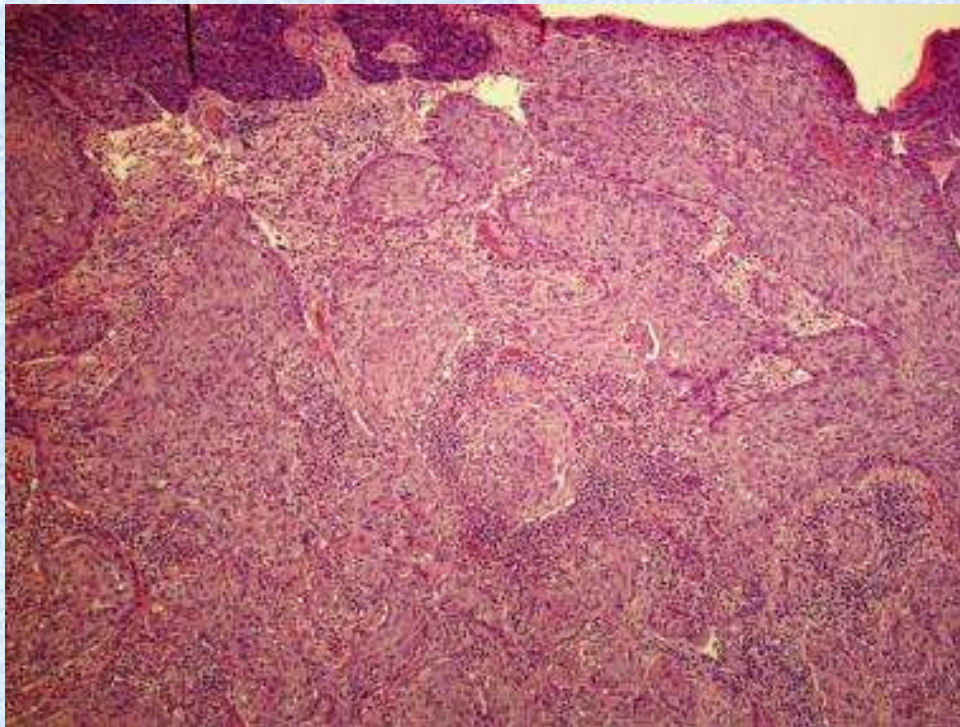
Malignant ulcer

Diseases of urinary bladder

Squamous cell carcinoma

Pathology:

MP:



Diseases of urinary bladder

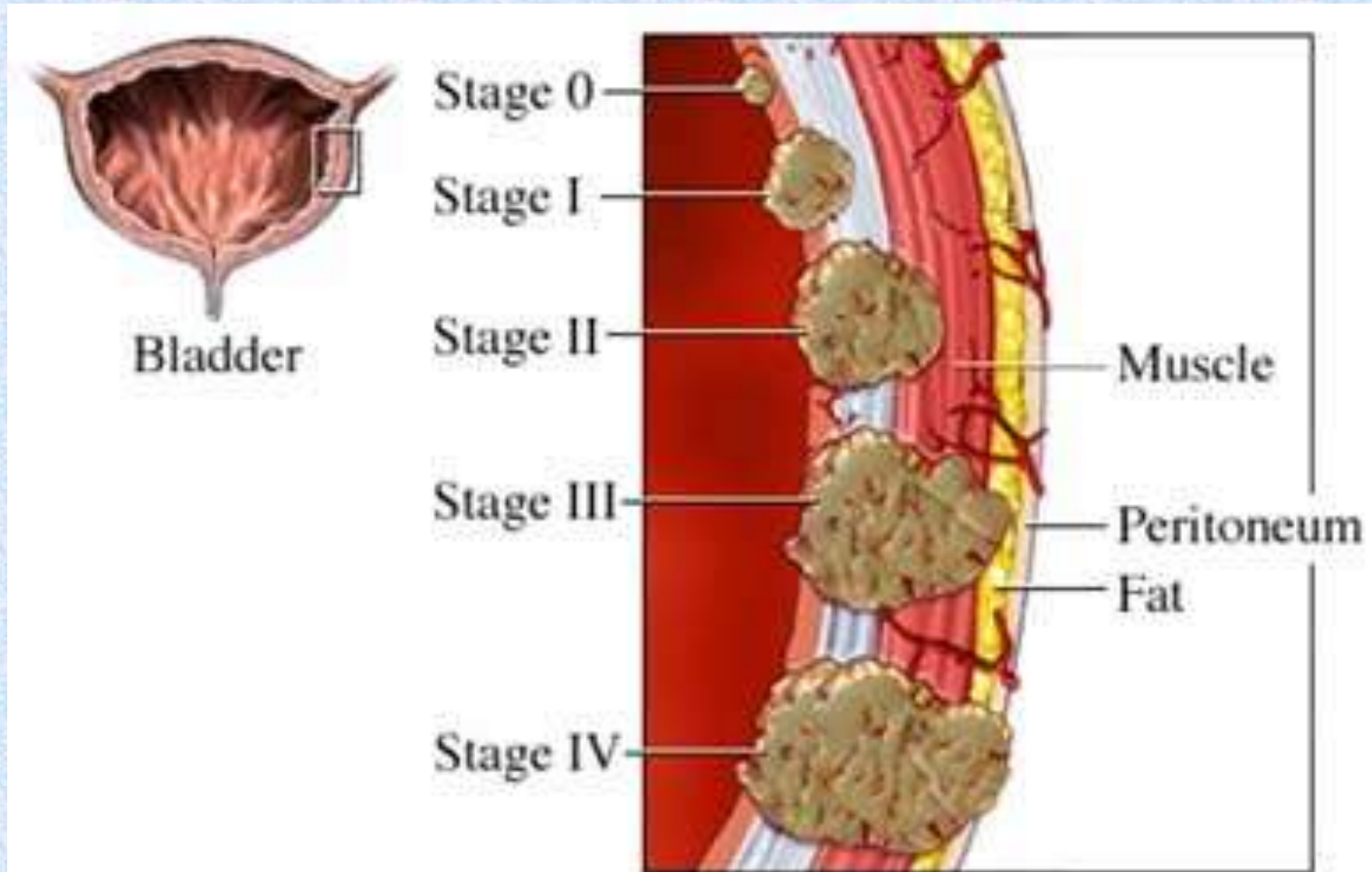
Spread of cancer bladder

1. ***Direct:*** to nearby structures as ureters, urethra, prostate, seminal vesicles, cervix and vagina
2. ***Lymphatic:*** internal iliac and para-aortic LNs
3. ***Hematogenous:*** lung, liver, bone and CNS

Diseases of urinary bladder

Tumors of urinary bladder

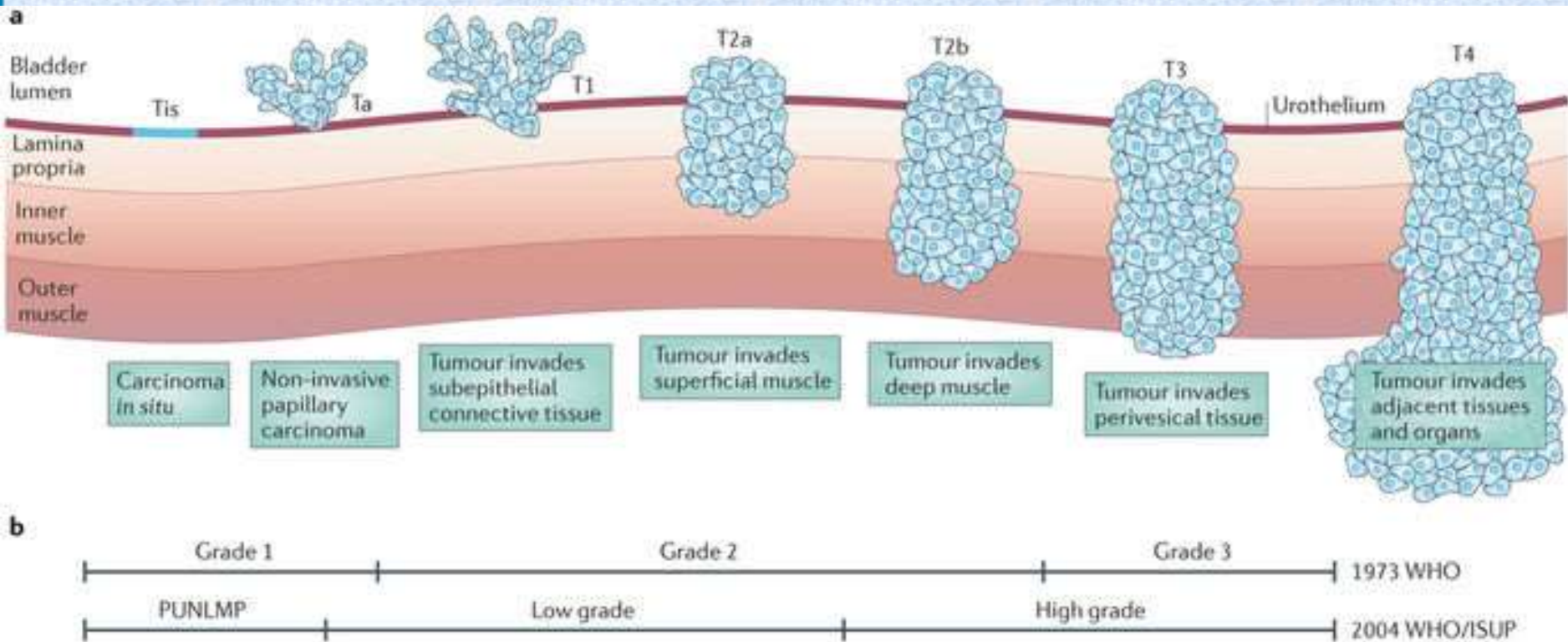
- Pathological staging of cancer bladder



Diseases of urinary bladder

Tumors of urinary bladder

■ Pathological staging of cancer bladder



Diseases of urinary bladder

Bilharzial and non bilharzial cancer bladder

	Bilharzial	Non bilharzial
Age	30-50yrs	Older than 50yrs
Etiology and Predisposing factors	<ul style="list-style-type: none">-Bilharziasis: leads to leukoplakia, cystitis glandularis, squamous metaplasia and dysplasia-Chronic cystitis by E coli with liberation of nitrates-Stones	<ul style="list-style-type: none">-Villous papilloma-Aniline dyes-Stones-Smoking-Chronic cystitis including bilharziasis
Grossly	<ul style="list-style-type: none">-Fungating mass (non-papillary)-Malignant ulcer-Infiltrative mass	<ul style="list-style-type: none">-Usually papillary mass.-Less commonly fungating, ulcerative or infiltrative mass

Diseases of urinary bladder

Bilharzial and non bilharzial cancer bladder

	Bilharzial	Non bilharzial
MP:	<ul style="list-style-type: none">-Sq. CC-TCC (non papillary or papillary)-Adenocarcinoma (rare)	<ul style="list-style-type: none">- TCC<ul style="list-style-type: none">•Papillary•Non papillary (invasive)- Adenocarcinoma (rare)
Spread: <i>-Direct</i> <i>-Lymphatic</i> <i>-Blood</i>	<ul style="list-style-type: none">-Common-Rare-Rare	<ul style="list-style-type: none">-Common-Relatively more common-Relatively more common
<i>-Chemotherapy</i>	-Chemo-resistant	-Commonly chemo-sensitive
<i>-Radiotherapy</i>	-Radio-resistant	-Commonly radiosensitive
<i>-Prognosis</i>	-Worse	-Relatively better

Diseases of urinary bladder

Hematuria

Definition: passage of blood with urine

Etiology:

1. Urinary bilharziasis
2. Inflammatory : cystitis, pyelonephritis, glomerulonephritis
3. Renal stones
4. Urinary bladder and renal tumors
5. Polycystic kidney
6. Prostatic causes: Benign prostatic hyperplasia
7. Circulatory disease: Renal congestion and renal infarction.
8. General causes: leukemia, purpura, hemophilia.....etc

Thank you