



# GENITOURINARY SYSTEM

SUBJECT : Pathology\_\_\_\_\_

LEC NO. : One\_\_\_\_\_

DONE BY : \_\_\_\_\_  
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# GENITOURINARY SYSTEM

يعطيكم العافية وريد ، عدنا لكم مع تفاريغ الباثو لهذا السيستم، و الي حتشمل شرح  
الدكتورة، و معلومات خارجية مفيدة، و برضه روابط فيديوهات مفيدة، و حيتم ارفاق كل  
تفريغ بملف يحوي ال most important و بملف يحوي اسئلة من تيست بانك

بشكل عام خلينا نتفق عالألوان الاتية

**اللون الأخضر : شرح الدكتورة**

**اللون الأحمر : معلومات مفيدة خارجية**

**الهايلايت الأصفر** للأفكار الهامة

**الهايلايت الأخضر** لأفكار نسال عنها بالإختبارات

بسم الله نبداً، لا تنسوننا بصالح دعائكم، و الله يقويننا لنقدر نكمل باقي المادة

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## Objectives

- Clinical manifestation of kidney disease
- understand the terminology of Renal diseases
- Discussion of Glomerular disease
- Nephrotic syndrome
- Nephritic syndrome
- Disease of blood vessels
- Urinary tract infection
- Analgesic nephropathy
- Acute Tubular Necrosis
- Hemolytic Uremic Syndrome
- Urolithiasis and hydronephrosis
- Renal Tumours RCC
- Bladder Tumours

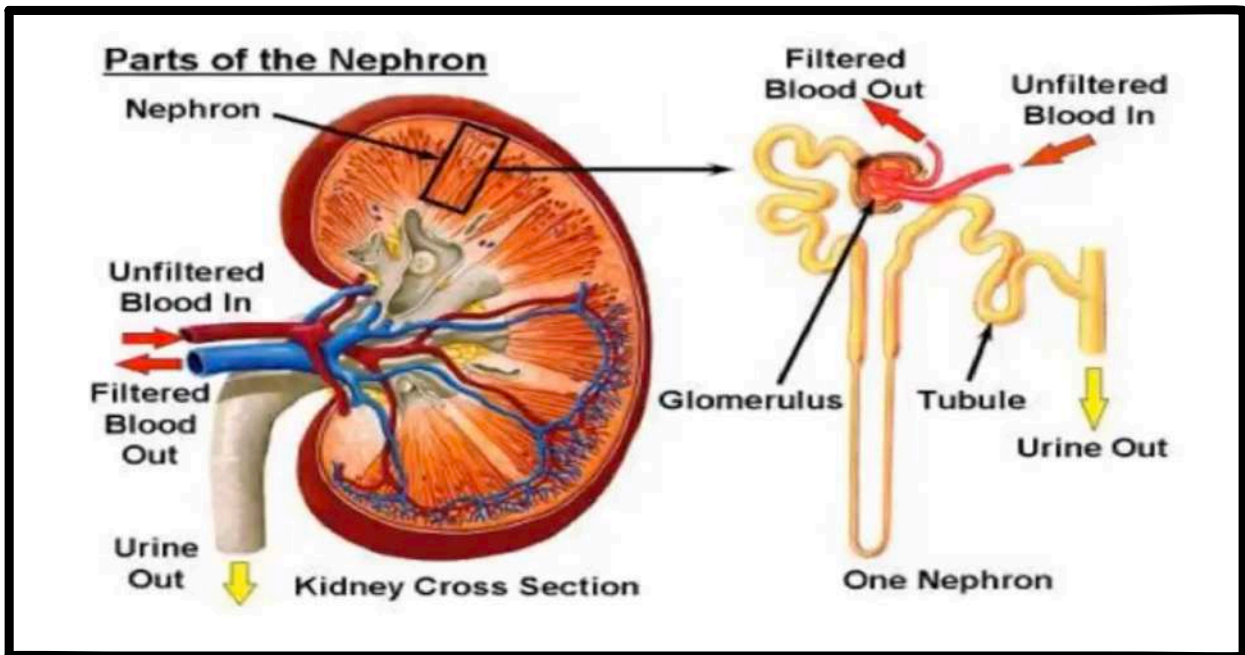
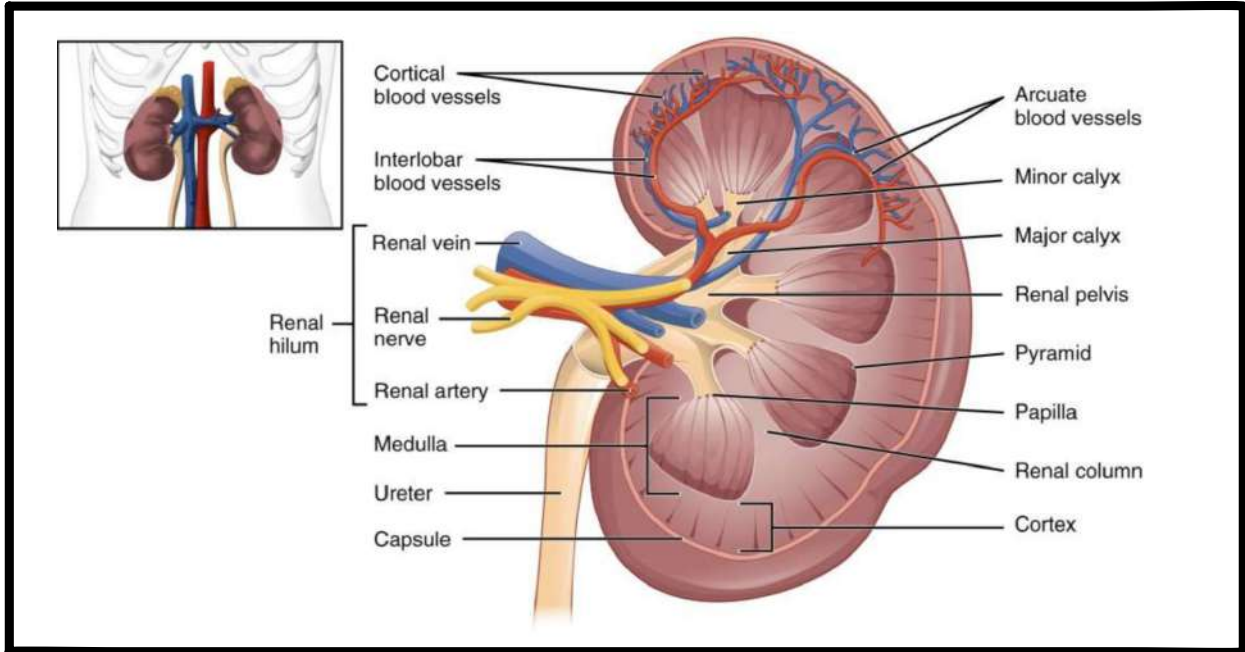
موضوع  
محاضرة  
اليوم

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## Normal Kidney structure



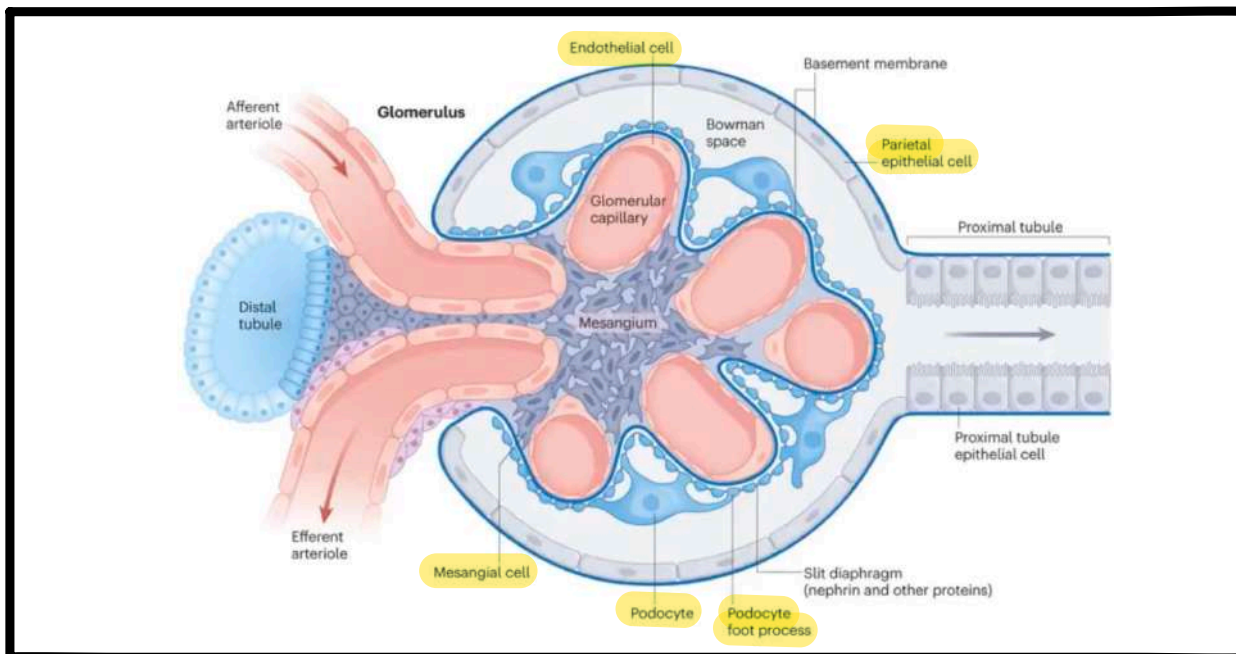
- \*The functional unit of the kidney is called the nephron.
- \*The nephron consists of several parts, including the renal corpuscle and renal tubule.
- \*The renal corpuscle comprises the Bowman's capsule and glomerulus.
- \*The renal tubule consists of the proximal tubule, loop of Henle, distal tubule, and connecting tubule.
- \*These components work together to **filter** and process blood, producing **urine** and maintaining **electrolyte** balance.

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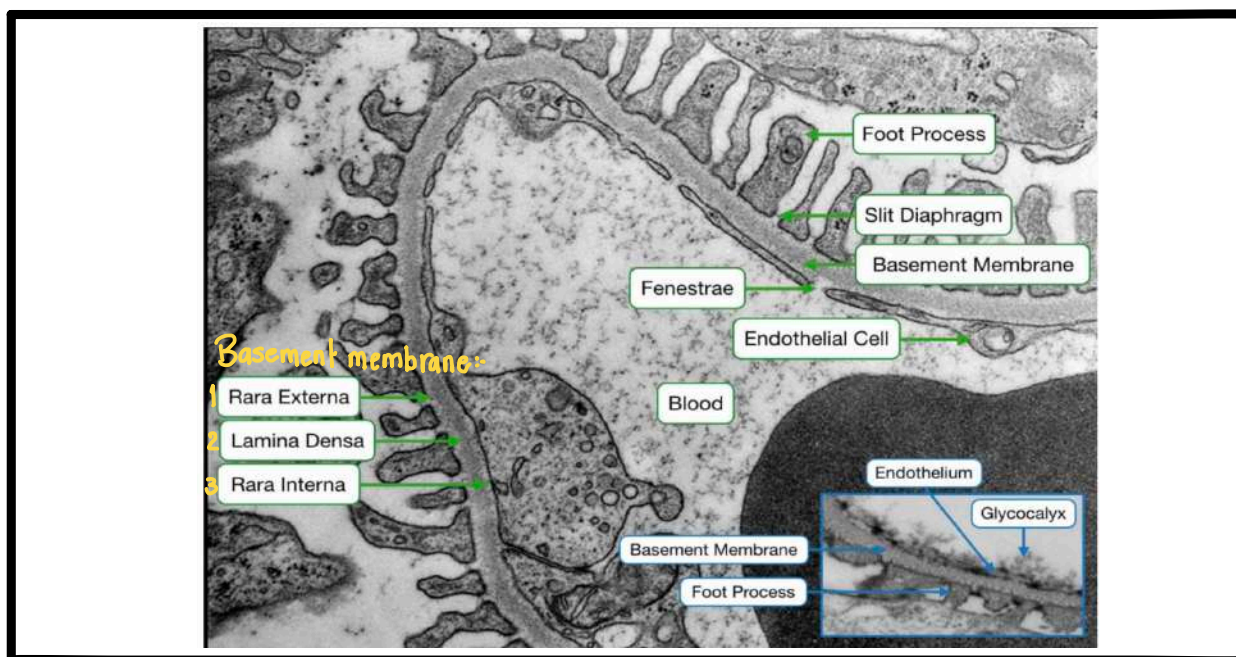




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- \*The glomerular capillaries are covered by **endothelial cells**. They have a fenestrated endothelium, allowing efficient filtration of blood components.
- \*Bowman's capsule surrounds the glomerulus. It is lined by a **parietal layer** forming the outer wall, and a visceral layer consisting of **podocytes**.
- \*Mesangial cells provide structural support to the glomerular capillaries.



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## Kidney diseases

**Kidney diseases** can be divided into those affecting the 4 basic components:

- (1) Glomeruli
- (2) Tubules
- (3) Blood vessels
- (4) Interstitium.

Because some components seem to be more vulnerable to specific forms of renal injury; e.g. **glomerular (G)** diseases are often **immunologically mediated**; whereas **tubular & interstitial** disorders are more likely to be caused by **toxic or infectious agents**,

\*immunological-mediated disease = antibody against antigen.

\*toxic agent = drugs, chemical components...

### ❑ The clinical manifestations of renal disease can be grouped into 8 major syndromes:

Some are peculiar to diseases of G; others are present in diseases that affect any one of the 4 components. These are:

**(1) Acute nephritic syndrome is** a G syndrome characterized by acute onset of **gross hematuria** (RBCs in urine), **mild to moderate proteinuria, edema, azotemia, & hypertension**; it is the classic presentation of acute post streptococcal GN.

**(2) The nephrotic syndrome is** a G syndrome characterized by **heavy proteinuria** (excretion of **>3.5 grams of protein/day** in adults), **hypoalbuminemia, severe edema, hyperlipidemia, & lipiduria** (lipid in the urine).

\*توضيح النقطة الأولى : نركز على hematuria و انها بتكون gross يعني بنشوفها بالعين المجردة؛ فالمرضى بيجي و ال urine تبعه لونه brown او tea like

\*توضيح النقطة الثانية : لما صار عنا leaking و loss لل albumin هاد الشئ ادى الى تقليل ال oncotic pressure في الدم مما يؤدي الى edema

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(3) **Asymptomatic hematuria or proteinuria, or** both, is usually a manifestation of subtle (mild) G abnormalities.

(4) **Rapidly progressive GN** manifested by **microscopic hematuria**, **dysmorphic RBC** & RBC casts in the urine & mild-to-moderate **proteinuria**, resulting in **loss of renal function** in a few days or weeks

↳ Not gross

(5) **Acute renal failure(RF) or (Acute Kidney Injury)** is dominated by **oliguria or anuria** (no urine flow),

ال **Asymptomatic hematuria** غالباً **بنلاحظه** لما **نعمل** **routine medical check-ups** او **urinalysis**

(7) **Urinary tract infection(UTI)** characterized by **bacteriuria& pyuria**(bacteria & leukocytes in the urine respectively).

The infection may be symptomatic or asymptomatic, & it may affect the kidney (pyelonephritis) or the bladder (cystitis).

بكون عند المريض **حرقة بالبول و حرارة و ألم**

(8) **Nephrolithiasis(renal stones)** is manifested by **renal colic, hematuria, & recurrent stone formation.**

□ UT obstruction & renal tumors represent specific anatomic lesions that often have varied manifestations.





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## Glomerular Disease

### Asymptomatic

Proteinuria 150 mg to 3 g per day  
Hematuria >2 red blood cells  
per high-power field in spun urine  
or >10 × 10<sup>6</sup> cells/liter  
(red blood cells usually dysmorphic)

**Asymptomatic glomerular disease refers to a condition affecting the glomeruli in the kidneys without the presence of noticeable symptoms. Glomerular diseases involve inflammation or damage to the glomeruli. The condition is detected incidentally through routine medical check-ups, blood tests, or urine analysis.**

### Macroscopic hematuria

Brown/red painless hematuria  
(no clots); typically coincides with  
intercurrent infection  
Asymptomatic hematuria ± proteinuria  
between attacks

**Macroscopic hematuria refers to the visible presence of blood in the urine (gross), pink, red, or brown discoloration.**

الدكتورة ضافت انه لو كانت المشكلة upper حيظهر لون البول بني و لو كان المشكلة بال lower parts او سببها infection او tumor فحيظهر باللون الأحمر

### Nephrotic syndrome

Proteinuria: adult >3.5 g/day;  
child >40 mg/h per m<sup>2</sup>  
Hypoalbuminemia <3.5 g/dl  
Edema  
Hypercholesterolemia  
Lipiduria

**Nephrotic syndrome occurs when glomeruli do not properly filter the protein albumin. Elevated levels of albumin in the urine is referred to as proteinuria.**

### Nephritic syndrome

Oliguria  
Hematuria: red cell casts  
Proteinuria: usually <3 g/day  
Edema  
Hypertension  
Abrupt onset, usually  
self-limiting

**Nephritic syndrome occurs when inflamed glomeruli do not properly filter red blood cells. Hematuria is the term for blood in the urine.**

### Rapidly progressive glomerulonephritis

Renal failure over days/weeks  
Proteinuria: usually <3 g/day  
Hematuria: red cell casts  
Blood pressure often normal  
May have other features of vasculitis

### Chronic glomerulonephritis

Hypertension  
Renal impairment  
Proteinuria often >3 g/day  
Shrunken smooth kidneys

بكون تطور ال glomerular disease سريع  
لدرجة يخاف يصير renal failure

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## Glomerular Disease

- One of the most common causes of chronic kidney disease and is major problems encountered in nephrology; and chronic GN is one of the most common causes of chronic kidney disease in humans.
- Glomerulonephritis (GN) is serious disorder that can lead to end-stage renal disease (ESRD), other serious morbidity, or death.
- GN is particular topic in nephrology with many clinical variants
- Could be asymptomatic or full blown
- Patients may come with abnormal urinalysis as the only presentation.
- Little is know about the epidemiology of GN, since no large scale examination of GN incidence and prevalence is available.

\*full-blown = symptoms and manifestations of the disease are pronounced and potentially more severe so treatment and management may need to be more intensive in such cases.

للفهم فقط  
و ليس  
للحفظ

The glomerulus normally consists of an anastomosing network of capillaries, invested by two layers of epithelium.

The visceral epithelium (**podocytes**) is an intrinsic part of the capillary wall, whereas the **parietal** epithelium lines **Bowman space**(urinary space), the cavity in which plasma ultrafiltrate first collects.

The G capillary wall is the filtration unit & consists of the following structures :

(I) A thin layer of fenestrated endothelial cells (EC).

(II) A glomerular basement membrane(GBM) with a thick, electron-dense central layer, the lamina densa,& thinner, electron-lucent peripheral layers, the lamina rara interna & lamina rara externa.

- The GBM consists of collagen (mostly type IV), laminin, proteoglycans, fibronectin, & several other glycoproteins.

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و ليس  
للحفظ

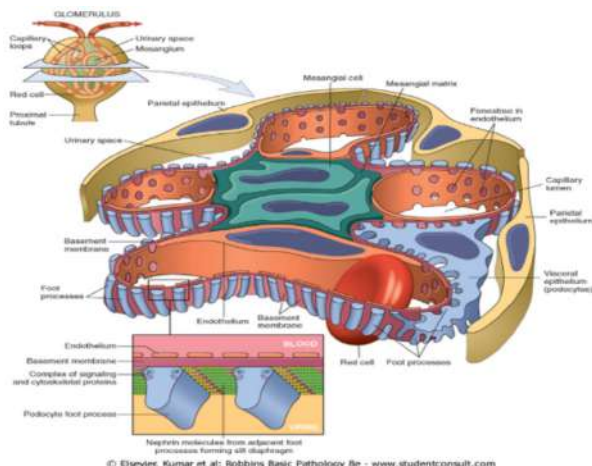
(III) The visceral epithelial cells (**podocytes**), structurally complex cells that possess interdigitating foot processes embedded in & adherent to the lamina rara externa of the GBM.

**The entire G tuft is supported by mesangial cells (of mesenchymal origin) lying between the capillaries**

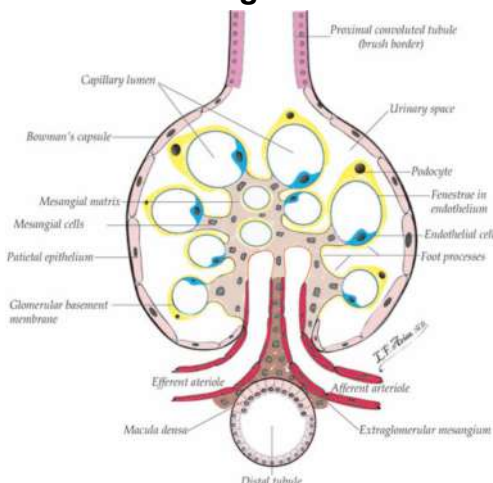
The major characteristics of GF are an extraordinarily **high permeability to water & small solutes** & an **almost complete impermeability to molecules of the size & molecular charge of albumin** (size: 3.6 nm).

This **selective permeability**, called **glomerular barrier function**, discriminates among protein molecules depending on their size (the larger, the less permeable), their charge (the more cationic (+), the more permeable), & their configuration.

**Schematic diagram of a lobe of a normal glomerulus**



**Representative scheme of a normal glomerulus.**



الامراض الي حنדרسها ممكن تكون بأي جزء من هاي الاجزاء، فمثلا لو عندي antibody-antigen complex فهو ممكن يعمل deposition بأي مكان من هالاماكن

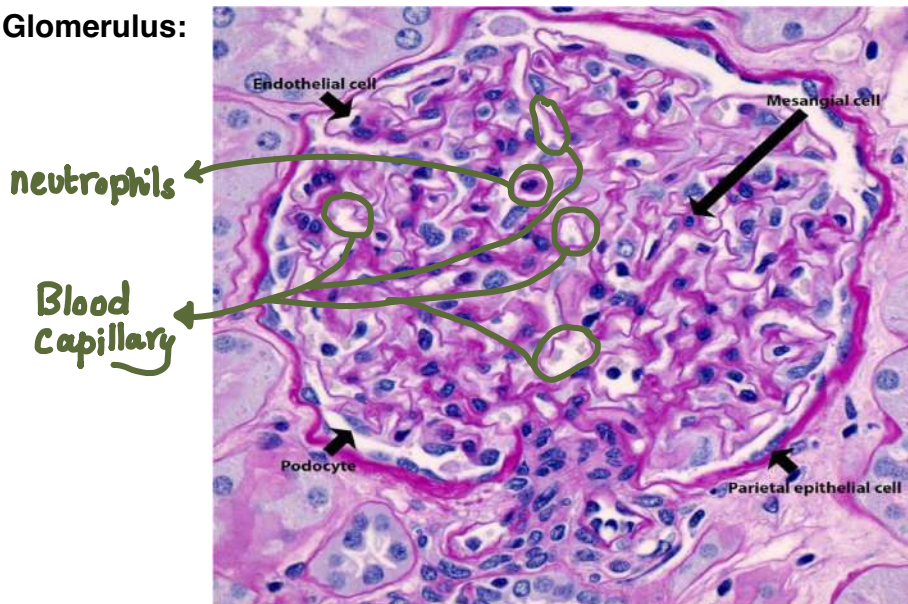
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Normal Glomerulus:

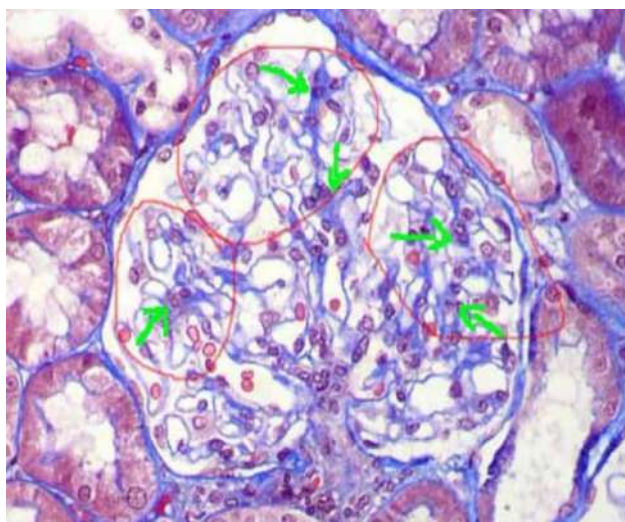


نوع ال stain المستخدمة هي PAS ، و بالصور الي حنوخدها مهم نميز كل صورة و شو ال stain المستخدمة فيها

The lobules appear highlighted in red; in normal glomeruli is difficult to determine with precision its limit.

Within each lobe there are several mesangial areas (some of them indicated with green arrows) in which there are not more than 2 or 3 nuclei of cells (Masson's trichrome, X300).

Stain type ↴



- \*The glomerular tuft is formed by lobules of capillaries.
- \*The afferent arteriole gives origin to 4 - 8 capillaries, each one of which is subdivided to form a lobule.
- \*In each lobule there are several mesangial areas: the portion of capillaries.
- \*It is very important to recognize the mesangial areas to determine when there is or non hypercellularity: cluster of three or more nuclei per mesangial area in thin 2 to 3 micron sections away from the vascular pole.

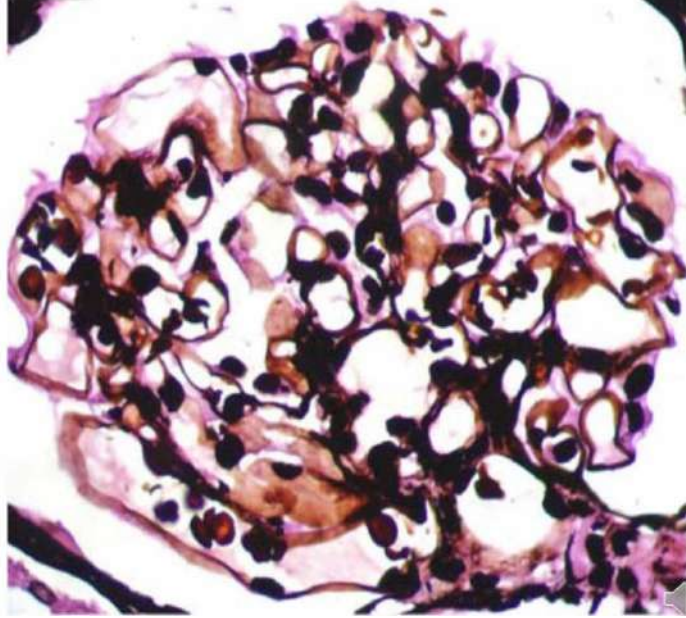
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The mesangial matrix, like the <sup>①</sup>basement membranes of capillaries, <sup>②</sup>Bowman's capsule, and <sup>③</sup>tubules are rich in type IV collagen, and has affinity by the methenamine-silver stain. See the irregular characteristic aspect of mesangial matrix (in black) in a normal glomerulus (Methenamine-silver, X.400).



اي شي فيه 4 collagen حيصبغ أسود

Glomeruli may be injured by diverse mechanisms, which are either :

- ❑ Primary G diseases, those in which the kidney is the only or predominant organ involved.
- ❑ Secondary G diseases in which the G may be injured in the course of a number of systemic diseases (hereditary , metabolic , vascular etc )

حتكون ال kidney وحدة من ال organs involved

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## Glomerular Diseases

متوقع سؤال which of the following

### (I) Primary Glomerular Diseases

حفظ

- Minimal-change disease (MCD)
- Focal and segmental glomerulosclerosis (FSGS)
- Membranous GN = Membranous nephropathy (MN)
- Membranoproliferative GN (MPGN)
- Acute postinfectious GN
- IgA nephropathy
- Chronic GN

هدول بس بصيروا بال kidney

### (II) Glomerulopathies Secondary to Systemic Diseases

حفظ

- Lupus (SLE) nephritis
- Diabetic nephropathy
- Goodpasture syndrome
- Microscopic polyangiitis
- Wegener's granulomatosis : this disease affects both kidney and lungs
- Henoch-Schönlein purpura
- Thrombotic microangiopathy
- Amyloidosis
- Bacterial endocarditis-related GN
- GN secondary to extrarenal infection
- GN secondary to lymphoplasma-cytic disorders

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## Glomerular diseases

### ● Primary Glomerular diseases

- Minor Glomerular abnormalities:  
Minimal Change disease
- Focal and/or segmental lesions:  
Focal glomerulosclerosis  
Focal proliferative glomerulonephritis
- Diffuse glomerulonephritis
- Chronic GN (Irreversible and most common cause of CRF)

### ● Glomerulopathies in Systemic diseases

- SLE
- Diabetes mellitus
- Goodpasture
- Bacterial endocarditis
- Amyloidosis
- Vascular disorders
  - Hypertension
  - PAN
  - Wegener's granulomatosis
  - Henoch-Schönlein purpura.

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# GENITOURINARY SYSTEM

Very important

اكيد عليهم سؤال ♥ و هم اساس المحاضرة

## Pathogenesis of Glomerular disease

- **Usually immune mediated** via antibody deposition, cell mediated injury or activation of alternative complement pathway
- **Antibodies deposited** are either to **in situ antigen (intrinsic or planted)** or are **circulating immune complexes**
- **Intrinsic: Good pasture disease antigens are** in basement membrane; **Heymann nephritis antigens are** on visceral epithelial cells; **produce linear immunofluorescence patterns.**
- **Planted antigens** are deposited in basement membrane; may be exogenous (**drugs, infectious agents**) or endogenous (**DNA, immunoglobulin, immune complexes**); their cationic proteins bind to glomerular anionic sites and produce **granular** lumpy staining by immunofluorescence

- **Circulating immune complexes** may be endogenous (DNA, tumors) or exogenous (infectious products); they usually localize within glomeruli and activate complement; deposits are usually **mesangial or subendothelial** and resolve by macrophage phagocytosis, unless there are repeated cycles of formation (Hepatitis B / C, lupus)
- **Cell mediated immune injury** is by sensitized nephritogenic T cells
- **Progression** to end stage renal disease occurs when the glomerular filtration rate (GFR) is **30 - 50%** of normal, due to compensatory hypertrophy of remaining glomeruli and systemic hypertension (inhibited by angiotensin converting enzyme inhibitors), eventually causing glomerulosclerosis

الصفحة القادمة تتضمن شرح تفصيلي ♥

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# GENITOURINARY SYSTEM

Very important

## Pathogenesis of Glomerular disease

- **Usually immune mediated** via antibody deposition, cell mediated injury or activation of alternative complement pathway

Antibodies or immune cells can target the glomerulus, leading to inflammation and damage. The complement system, part of the immune response, may also play a role in causing injury to the glomeruli. Understanding these processes helps in comprehending the development and progression of glomerular diseases.

- **Antibodies deposited** are either to **in situ antigen (intrinsic or planted)** or are **circulating immune complexes**

Two forms of antibody-associated injury have been established:

(1) injury resulting from deposition of soluble **circulating** antigen-antibody complexes in the glomerulus.

(2) injury by antibodies reacting in situ within the glomerulus, either with insoluble fixed (**intrinsic**) glomerular antigens or with molecules **planted** within the glomerulus.

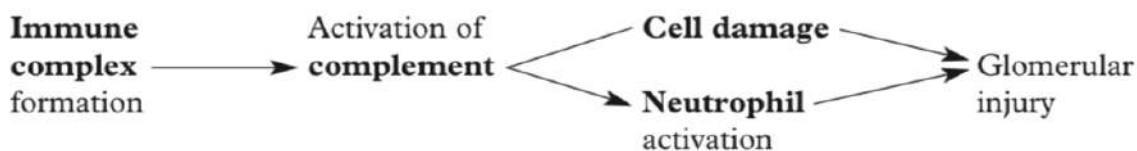
**Intrinsic:** Good pasture disease antigens are in basement membrane; Heymann nephritis antigens are on visceral epithelial cells; produce linear immunofluorescence patterns.

Good Pasture disease : a group of acute illnesses that affects the lungs and kidneys (systemic disease)

**Planted antigens** are deposited in basement membrane; may be exogenous (**drugs, infectious agents**) or endogenous (**DNA, immunoglobulin, immune complexes**); their cationic proteins bind to glomerular anionic sites and produce **granular** lumpy staining by immunofluorescence

درسنا سابقاً أنه hepatitis C + D ممكن يعملوا لنا complication و هو GN لانو هاد الفايروس ممكن يصير planted على ال basement membrane و يعمل stimulation لل immune response

The mechanism in most forms of GN is:



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**Circulating immune complexes** may be endogenous (DNA, tumors) or exogenous (infectious products); they usually localize within glomeruli and activate complement; deposits are usually **mesangial or subendothelial** and resolve by macrophage phagocytosis, unless there are repeated cycles of formation (**Hepatitis B / C, lupus**) حسب وين عمل deposition بنقرر لو  
كلمة cvclina اه planted

**Cell mediated immune injury** is by sensitized nephritogenic T cells

**Progression** to end stage renal disease occurs when the glomerular filtration rate (GFR) is **30 - 50%** of normal, due to compensatory hypertrophy of remaining glomeruli and systemic hypertension (inhibited by angiotensin converting enzyme inhibitors), eventually causing glomerulosclerosis

معظم الكيسات تنتهي ب Renal failure و خصوصا لو قل GFR الى 30% يعني الكلية مو قادرة تصفي الا 30% من الدم مما يؤدي الى زيادة نسبة Urea و Creatinine و Uriac Acid في الجسم، و من هون في مصطلحين مهمين مو بالسلايدات لازم نركز عليهم :

**What is the difference between azotemia and uremia?**

\***Azotemia** is a medical condition characterized by abnormally high levels of nitrogen-containing compounds (such as urea, creatinine, various body waste compounds, and other nitrogen-rich compounds) in the blood.

It is largely related to insufficient or dysfunctional filtering of blood by the kidneys. It can lead to uremia if not controlled.

ملخص : مهم نعرف شو بزيد فيها لما اطلب lab test و مهم نعرف انها asymptomatic

\***Uremia** represents the entire constellation of signs and symptoms of chronic renal failure, including nausea, vomiting, anorexia, a metallic taste in the mouth, a characteristic odor of breath, pruritus, urea frost on the skin, neuromuscular disorders, pain and twitching in muscles, hypertension, edema, mental confusion, and acid-base and electrolyte imbalances.

هون مهم نعرف انها بتكون symptomatic

**Azotemia** refers to an elevation of Blood Urea Nitrogen (BUN) and creatinine levels.

**Uremia** = Azotemia + Clinical signs and symptoms + Biochemical abnormalities

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\*Kidney hypoperfusion results from reductions in the effective arterial blood volume.

\*Activation of the intrarenal baroreceptor mechanism results in the secretion of renin and increased formation of ANG II. Increased ANG II levels elevate renal artery perfusion pressure beyond the stenosis toward normal levels while leading to systemic hypertension + glomerulosclerosis could occur.

1. **Reduced Perfusion:** Kidney hypoperfusion, whether due to decreased effective arterial blood volume or other factors, can compromise renal function, leading to reduced filtration in the glomeruli.

2. **Renin-Angiotensin System (RAS) Activation:** In response to reduced perfusion, the kidneys activate the RAS, leading to the release of renin. Renin initiates a cascade that ultimately results in the production of angiotensin II (ANG II), a potent vasoconstrictor.

3. **Vasoconstriction and Fibrosis:** ANG II, in addition to its role in regulating blood pressure, has direct effects on the renal vasculature. Prolonged vasoconstriction and increased pressure within the glomeruli can contribute to damage and scarring, known as glomerulosclerosis.

4. **Inflammation and Fibrosis:** The chronic activation of the RAS and sustained renal injury can trigger inflammatory responses and the deposition of fibrous tissue in the glomeruli. Over time, this fibrosis can lead to glomerulosclerosis, characterized by the scarring and hardening of the glomeruli.



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## Pathogenesis of Glomerular Diseases

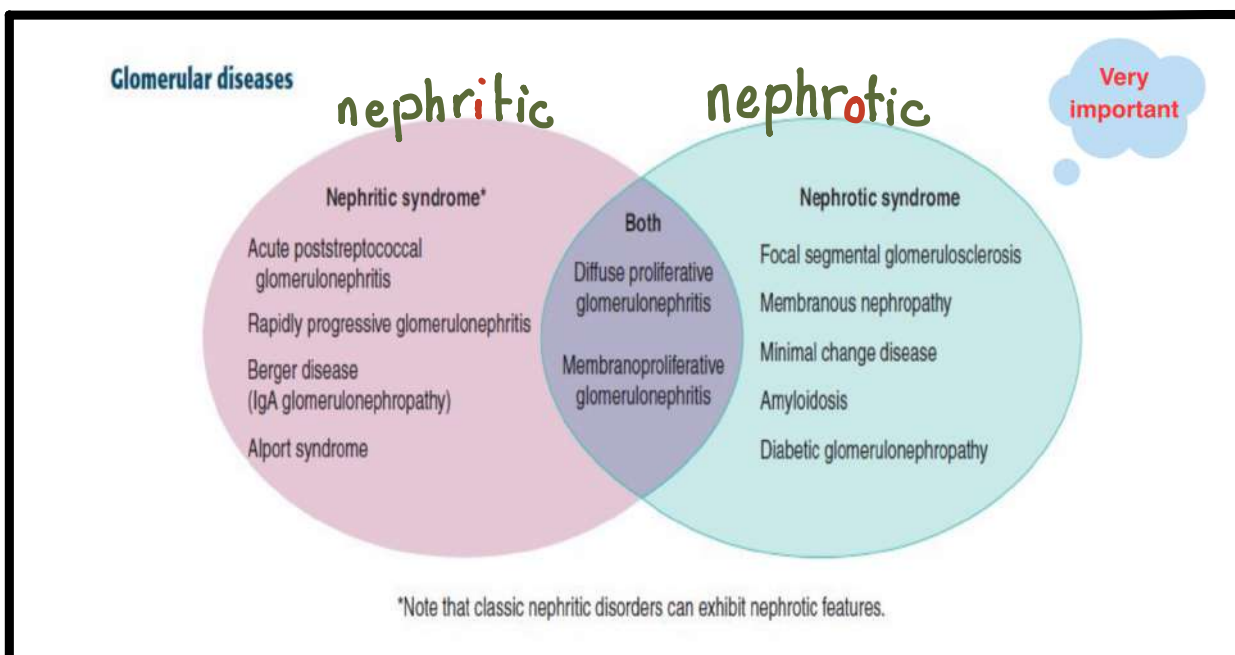
### • Antibody-associated

- (1) injury resulting from deposition of soluble circulating Ag-Ab complexes in the glomerulus.
- (2) injury by Abs reacting in situ within the glomerulus.
- (3) Abs directed against glomerular cell components.

### 1-Nephritis Caused by Circulating Immune Complexes

- The antigen is not of glomerular origin.
- 1- **endogenous** as in the GN associated with SLE.
- 2- **exogenous** as in the GN that follows certain bacterial (streptococcal), viral (hepatitis B), parasitic (*Plasmodium falciparum* malaria), and spirochetal (*Treponema pallidum*) infections

Antibodies to DNA (anti-DNA) are the serological hallmark of systemic lupus erythematosus, a prototypic autoimmune disease



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\*تمام اول شي كثير مهمة الأمتلة، و ممكن الدكتور توجب سؤال all the following are except

\*النephrotic ال تتميز بوجود periorbital edema و bilateral edema في القدمين، و برضه protein urea

\*النephritic ال تتميز ب hematuria و تعتبر أخطر بالغالب



فكرة  
سؤال

A 30 year old male patient came to ER with hematuria, all the following are differential diagnosis except :

- A- Acute poststreptococcal glomerulonephritis
- B- Rapidly progressive glomerulonephritis
- C- Berger disease
- D- Amyloidosis

كلمة hematuria هي الكلمة المفتاحية 🎉 و الجواب هو D

A 6 year old child came to your clinic with periorbital edema, all the following are differential diagnosis except :

- A- Focal segmental glomerulosclerosis
- B- Membranous nephropathy
- C- Berger disease
- D- Amyloidosis

النephrotic ال هي الكلمة المفتاحية 🎉 و الجواب الصحيح هو C

و بس والله ❤️ هيك بتكون خلصت المحاضرة الاولى الي هي مقدمة بسيطة للمادة، ما في داعي كثير تتوسعوا بالمعلومات لانه كله حنفضله ❤️ لو في اي تعديل عالترفيغ حأبلغكم بالكومنتات، و حأضيفه ملف التعديلات ❤️

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