Pathophysiology of kidney disease

- When discussing the pathophysiology of Kidney diseases, renal structural and physiological characteristics, as well as the principles of renal tissue injury and repair should betaken into consideration.

1. The **rate of renal blood flow of approximately 400 ml/100g of tissue per minute**

In a single day, your kidneys filter about 150 Liters of blood. Most of the water and other substances that filter through your glomeruli are returned to your blood by the tubules. Only 1 to 2 Liters become urine.

2. It is much greater than that observed in other well perfused vascular beds such as **heart, liver and brain**.

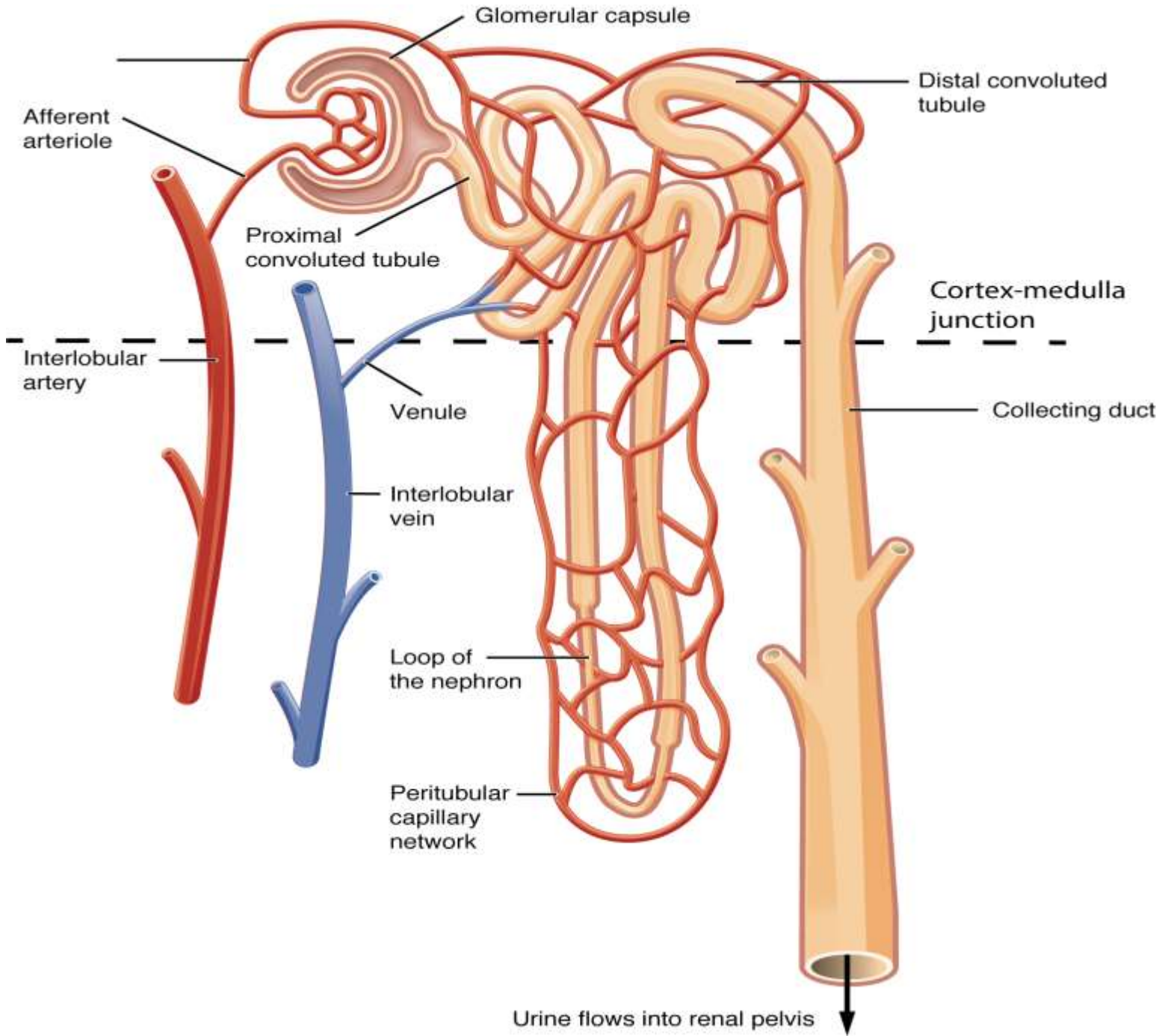
as a consequence, renal tissue might be exposed to a significant quantity of any potentially harmful circulating agents or substances.

3.Glomerular filtration is dependent on rather high intra- and trans glomerular pressure (even under physiologic conditions), rendering the glomerular capillaries vulnerable to hemodynamic injury, in contrast to other capillary beds.

4. Glomerular hypertension and hyperfiltration are major contributors to the progression of chronic renal disease.

5. Glomerular filtration membrane has negatively charged molecules which serve as a barrier retarding anionic macromolecules. With disruption in this electrostatic barrier, as is the case in many forms of glomerular injury, plasma protein gains access to the glomerular filtrate.

6. Glomerular convolute and the peritubular capillary network, and the downstream position of the tubule with respect to glomeruli, not only maintains the glomerular-tubular balance but also facilitates the spreading of glomerular injury to tubulointerstitial compartment in disease, **exposing tubular epithelial cells to abnormal ultrafiltrate**


Glomerular capsule
Distal convoluted tubule
Afferent arteriole
Proximal convoluted tubule
Cortex-medulla junction
Interlobular artery
Venule
Collecting duct
Interlobular vein
Loop of the nephron
Peritubular capillary network
Urine flows into renal pelvis

7. As peritubular vasculature underlies glomerular circulation, **some mediators of glomerular inflammatory reaction may overflow into the peritubular circulation** contributing to the interstitial inflammatory reaction frequently recorded in glomerular disease. Moreover, any decrease in preglomerular or glomerular perfusion **leads to decrease in peritubular blood flow**, which, depending on the degree of hypoxia, entails tubulointerstitial injury and tissue remodeling.

8. Thus, the concept of the nephron as a functional unit applies not only to renal physiology, but also to the pathophysiology of renal diseases.

9. In the fifth place, the glomerulus itself should also be regarded as a functional unit with each of its individual constituents, i.e. endothelial, mesangial, visceral and parietal epithelial cells - podocytes, and their extracellular matrix representing an integral part of the normal function.

10. Damage to one will in part affect the other through different mechanisms, direct cell-cell connections (e.g., gap junctions), soluble mediators such as chemokines, cytokines, growth factors, and changes in matrix and basement membrane composition.

The main causes of renal injury

1. Based on **immunologic reactions** (initiated by immune complexes or immune cells),
2. tissue hypoxia and ischemia,
3. exogenic agents like drugs,
4. endogenous substances like glucose or paraproteins and others,
5. and genetic defects.
6. Irrespective of the underlying cause glomerulosclerosis and
7. tubulointerstitial fibrosis are common to CKD.

• An overview of the pathophysiology of CKD should give special consideration to mechanisms of glomerular, tubular and vascular injury.

Renal diseases

- Multicyclic Dysplastic Kidney.

Multicyclic dysplastic kidney is a condition in which the kidney has been essentially replaced by multiple cysts. It is the result of abnormal fetal development of the kidney. There is little or no normal function to this kidney.

- Nephrotic Syndrome in Adults.
- Nephrotic syndrome usually happens when the glomeruli are inflamed, allowing too much protein to leak from your blood into your urine. As blood passes through healthy kidneys, the glomeruli filter out waste products and allow the blood to keep the cells and proteins the body needs.

•Polycystic Kidney Disease (PKD)

Polycystic kidney disease (PKD) is a genetic disorder that causes many fluid-filled cysts to grow in your kidneys. Unlike the usually harmless simple kidney cysts that can form in the kidneys later in life, PKD cysts can change the shape of your kidneys, including making them much larger.

•Renal Artery Stenosis.

Renal artery stenosis is the narrowing of one or more arteries that carry blood to your kidneys (renal arteries). Narrowing of the arteries prevents enough oxygen-rich blood from reaching your kidneys. Your kidneys need adequate blood flow to help filter waste products and remove excess fluids.

•Renal Tubular Acidosis.

What is renal tubular acidosis? Renal tubular acidosis (RTA) occurs when the kidneys do not remove acids from the blood into the urine as they should. The acid level in the blood then becomes too high, a condition called acidosis. Some acid in the blood is normal, but too much acid can disturb many bodily functions.

•Simple Kidney Cysts.

Simple kidney cysts are fluid-filled sacs that can form in one or both of your kidneys. Simple kidney cysts are usually harmless and **don't cause symptoms**.

•Solitary or Single-functioning Kidney.

What is solitary kidney? Solitary kidney is a condition in which a person has a single kidney instead of two kidneys. A person may be born with one kidney (renal agenesis), have two kidneys but only one functional (renal dysplasia) or lose one kidney to a disease, such as kidney cancer.