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1. The nephrons in desert mammal Camel are equipped with well-developed Henle's loop and number of juxtamedullary nephrons in kidneys is very high, about 35% (in man this number is about 15%).

Desert mammals do not readily find water, hence they must excrete very less amount of water. They are able to produce highly concentrated urine.

The Henle's loop of juxtamedullary nephron goes deep down into the medulla. This is why medulla of camel's kidney is thicker than that of other mammals, but it is most well developed in another desert mammal, the kangaroo rats. The Henle's loops of juxtamedullary nephrons along with counter flowing blood vessels, called vasa recta, help in conservation of water.

 Blood first flows along ascending limb of Henle, which is impermeable to water. Solutes can leave the filtrate and enter the blood along this stretch. When this blood flows along descending limb, water is reabsorbed from filtrate but not the solutes. Longer the Henle's loop, more amount of solute will be reabsorbed and hence more amount of water could be removed from filtrate.

**2.) The glomerular filtration barrier**

The glomerular capillaries are lined by a fenestrated endothelium that sits on the glomerular basement membrane, which in turn is covered by glomerular epithelium, or podocytes, which envelops the capillaries with cellular extensions called foot processes. In between the foot processes are the filtration slits. These three structures; the fenestrated endothelium, glomerular basement membrane, and glomerular epithelium are the glomerular filtration barrier.

**Clinical Applications**

**Nephrotic Syndrome**

The nephrotic syndrome is a set of symptoms that include the following:

• Protein in the urine;

• Low blood protein levels;

• Swelling or edema.

 It may also include elevated levels of serum lipids, anaemia, and vitamin D deficiency, all because of loss of plasma proteins into the urine. This can have multiple causes, but all involve defects in the glomerular barrier to proteins so that excess proteins are filtered and thereby excreted in the final urine. The three barriers: the fenestrated endothelial cell layer, the GBM, and the podocyte and slit diaphragm.

Nephrotic syndrome can be primary or secondary. Primary causes are described by their histological changes: minimal change disease, focal segmented glomerulosclerosis, and membranous nephropathy. Secondary causes are described by their underlying cause, which include diabetes mellitus, sarcoidosis, hepatitis B, hepatitis C, bacterial infections, parasitic infections, etc.

 All of the diseases are characterized by protein in the urine, at least 3.5 g per 24 h. The loss of protein can cause hypoalbuminemia, with resulting edema that may show as puffiness around the eyes, pitting edema in the legs, and pleural effusion. Loss of proteins stimulates liver synthesis, including lipoproteins. Because lipoprotein lipase levels fall, lipoprotein levels increase. Loss of vitamin D binding protein can lead to vitamin D deficiency diseases, with calcium malabsorption and bone disease.

**Membranous glomerulonephritis** is one of the more common causes of nephrotic syndrome in adults. It is an inflammatory disease, believed to be caused by binding of antibodies to antigens in the GBM that triggers the formation of a membrane attack complex from complement. This triggers release of proteases and oxidants that damage the capillary walls, causing them to become leaky.

Treatment depends on etiologic. For all nephrotic syndromes, monitoring and maintaining normal fluid levels and distribution among the body compartments are the goal. This could include restriction of fluid intake, restriction of salt intake, regular monitoring of blood pressure and urine output, and the use of diuretics. Inflammatory causes of nephrotic syndrome are treated with immunosuppressants such as prednisolone and dietary modification.

**Chronic kidney disease**

Chronic kidney disease occurs when a disease or condition impairs kidney function, causing kidney damage to worsen over several months or years.

Diseases and conditions that cause chronic kidney disease include:

* Type 1 or type 2 diabetes
* High blood pressure
* Glomerulonephritis, an inflammation of the kidney's filtering units (glomeruli)
* Interstitial nephritis, an inflammation of the kidney's tubules and surrounding structures
* Polycystic kidney disease
* Prolonged obstruction of the urinary tract, from conditions such as enlarged prostate, kidney stones and some cancers
* Vesicoureteral) reflux, a condition that causes urine to back up into your kidneys
* Recurrent kidney infection, also called pyelonephritis

**Glomerulosclerosis**

Glomerulosclerosis refers to scarring or hardening of the glomeruli -- blood vessels located in the kidneys. The glomeruli filter the blood as it passes through the kidneys. They remove waste fluids that then leave the body as urine. Damaged glomeruli can't perform their job adequately. As a result, large amounts of protein from the blood leak into the urine rather than remaining in the bloodstream. This leads to a condition called proteinuria.

**Focal segmental glomerulosclerosis (FGSH)**

 Many diseases and conditions can affect your kidney function by attacking and damaging the glomeruli, the tiny filtering units inside your kidney where blood is cleaned. These diseases and conditions are called glomerular diseases and can have many different causes. Focal Segmental glomerulosclerosis is a type of glomerular disease and describes scarring (sclerosis) in your kidney. The scarring of FSGS only takes place in small sections of each glomerulus (filter), and only a limited number of glomeruli are damaged at first. Focal Segmental Glomerulosclerosis affects both children and adults. Males are affected slightly more often than females, and it occurs more frequently in African Americans

**Causes**

FSGS is not caused by a single disease. It can have many different causes. The scarring may happen because of an infection, or drug, or a disease that affects the entire body, like diabetes, HIV infection, sickle cell disease or lupus. FSGS can also be caused by another glomerular disease that you had before you got FSGS. FSGS has different types based on the cause.

**Types**

1. Primary FSGS: This type of FSGS means that the disease happened on its own without a known or obvious cause.
2. Secondary FSGS: This type is caused by another disease or a drug. Examples include: viruses such as HIV or drugs such as anabolic steroids that some people use to speed up their muscle growth (these are different than steroids your doctor gives you for treatment).

**Proteinuria**

Proteinuria is increased levels of protein in the urine. This condition can be a sign of kidney damage.

Proteins – which help build muscle and bone, regulate the amount of fluid in blood, combat infection and repair tissue – should remain in the blood. If proteins enter the urine they ultimately leave the body, which isn’t healthy. Protein gets into the urine if the kidneys aren’t working properly. Normally, glomeruli, which are tiny loops of capillaries (blood vessels) in the kidneys, filter waste products and excess water from the blood. Glomeruli pass these substances, but not larger proteins and blood cells, into the urine. If smaller proteins sneak through the glomeruli, tubules (long, thin, hollow tubes in the kidneys) recapture those proteins and keep them in the body. However, if the glomeruli or tubules are damaged, if there is a problem with the reabsorption process of the proteins, or if there is an excessive protein load, the proteins will flow into the urine.

Normal amount of protein in the urine are less than 150mg/day. High levels of protein in the urine are associated with rapid decline in kidney function. It affects about 6.7 percent of the United States population. It is seen more in elderly and people with other chronic illnesses.

**Causes**

In many cases, proteinuria is caused by relatively benign (non-cancerous) or temporary medical conditions. These include dehydration, inflammation and low blood pressure. Intense exercise or activity, emotional stress, aspirin therapy and exposure to cold can also trigger proteinuria. In addition, a kidney stone in the urinary tract can cause proteinuria. Occasionally, proteinuria is an early indication of chronic kidney disease, a gradual loss of kidney function that may eventually require dialysis or a kidney transplant. Diabetes and high-blood pressure can damage kidneys and are the number-one and number-two causes of kidney disease.

Other potentially kidney-harming diseases and medical conditions, which can lead to proteinuria, include:

* Immune disorders like lupus and Goodpasture’s syndrome
* Acute inflammation of the kidney (glomerulonephritis)
* Cancer of plasma cells (multiple myeloma)
* Intravascular haemolysis, which is the destruction of red blood cells and release of haemoglobin in the bloodstream
* Cardiovascular disease
* Preeclampsia, the simultaneous development of hypertension and proteinuria in a pregnant woman
* Poisoning
* Trauma
* Kidney cancer
* Congestive heart failure

**Symptoms**

Often, someone with proteinuria doesn’t experience symptoms, especially if kidneys are just beginning to have problems. However, if proteinuria is advanced, symptoms can include:

* More frequent urination
* Shortness of breath
* Tiredness
* Nausea and vomiting
* Swelling in the face, belly, feet or ankles
* Lack of appetite
* Muscle cramping at night
* Puffiness around the eyes, especially in the morning
* Foamy or bubbly urine

**Microalbuminuria**

Microalbuminuria means that there’s a small increase in the level of a protein called albumin in your urine compared to normal. It can be an early sign of kidney disease, which often occurs as a complication of diabetes and other conditions.

Albumin is a protein in your blood. Your kidneys filter your blood to remove waste products, which are lost from your body in your urine when you pee. Normally, with healthy kidneys, very little protein (including albumin) is passed into your urine during this process. But if blood vessels in your kidneys are damaged, more protein leaks from your kidneys into your urine (albuminuria or proteinuria).

Microalbuminuria simply means the increase in albumin is relatively small or moderate. But even this low level of albumin in your urine can suggest you may have an early phase of chronic kidney disease. Doctors use your albumin level, along with results of other tests to diagnose chronic kidney disease and estimate how quickly your condition is likely to progress.

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