

CHRONIC KIDNEY DISEASE (CKD) THE SILENT KILLER

Siddharta S. Ghosh², Shobha Ghosh¹

¹*Department of Internal Medicine, Division Nephrology, Virginia Commonwealth University, Virginia, USA.*

²*Department of Internal Medicine, Division Pulmonary and Critical Care, Virginia Commonwealth University, Virginia, USA.*

ABSTRACT

CKD or chronic kidney disease they usually will be very confused as to the nature of the disease. Even websites for CKD are difficult for common people to understand. It is to be noted that most patients with CKD die from cardiovascular events such as heart failure. CKD is an important multiplier of risk for many chronic noncommunicable diseases, including cardiovascular disease and cancer. There is no cure for CKD and only treatment available is to control symptoms such as diabetes, hypertension, hyperkalemia etc. In this article I have not talked about maybe treatment and pathophysiology can be dealt about later.

Key Words: *Chronic Kidney Disease (CKD), Nephron,*

Most people when they are diagnosed with diabetes or high blood pressure, they generally understand what is happening. If they don't understand they can look up the internet and get a fairly detailed picture of the disease process. However, if somebody is told that they have CKD or chronic kidney disease they usually will be very confused as to the nature of the disease. Even websites for CKD are difficult for common people to understand. National Kidney Foundation of America (NKF) website developed by doctors, nurses, and scientists lists the following nine symptoms describing CKD:

1. Feel more tired and have less energy
2. Have trouble concentrating
3. Have a poor appetite
4. Have trouble sleeping
5. Have muscle cramping at night
6. Have swollen feet and ankles
7. Have puffiness around your eyes, especially in the morning
8. Have dry, itchy skin
9. Need to urinate more often, especially at night

If you look at the symptoms carefully they can be misunderstood for many other diseases. If you are

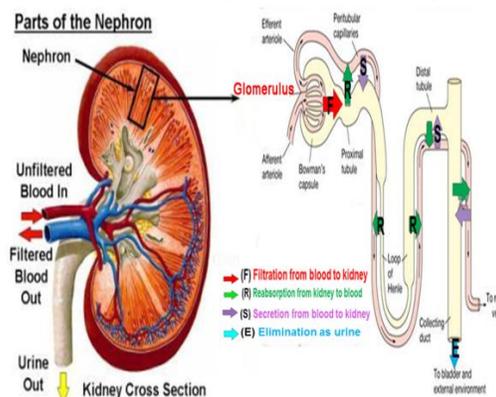


Fig. 1: Kidney is composed of nephrons which filters the soluble waste in the blood to produce urine

under the weather you can feel tired, may lack concentration, lose appetite and have trouble sleeping. In fact, all the symptoms can be attributed to tiredness. Symptom 9 can relate to diabetes which makes it very difficult to understand and diagnose CKD. Sometimes it can be missed even by family physicians.

Obviously, the question is why is that so? Why is it difficult to diagnose?

Why is it difficult to diagnose?

To answer the question, we need to understand how the kidney function. Every day we are eating, drinking, and inhaling many things. The body has to get rid of the waste materials. We use our lungs to breathe out gaseous waste, the liver and the intestine are involved in getting rid of the solid waste and the kidney's job is to get rid of the liquid waste. As shown in figure 1 the kidney is made up of millions of nephrons. A nephron consist glomerulus, proximal tubule, loop of Henle, distal tubule and collecting duct. The glomerulus is the main filtration unit. The kidney filters about 180 liters blood every day. The process is called glomerular filtration (shown by the red arrow in figure 1). All water soluble small molecules such as glucose, amino acids are filtered but high molecular weight substances such as albumin is not filtered. Thus, molecules of radii less than 20 angstrom are not restricted whereas molecules with higher than 20 angstrom gets restricted passage and molecules greater than 42 angstrom are completely restricted(4). Besides size charge is also important for filtration hence positively charged molecules are better filtered than negatively charged molecules. Later in the article I will discuss about glomerular filtration or GFR and its importance in CKD in more details. Now let us discuss what happens to the filtered material from the blood. The kidney at the very outset filters everything including important metabolic products such as glucose, sodium, amino acids etc. Fortunately, the kidney has the capability of self-regulation (details of the process can be dealt another time). The filtrate which is the original urine will then be modified in successive segments of the nephron. The essential components like glucose and amino acids will be reabsorbed in the blood (shown by green arrows) at different parts of the nephron. Excess materials which did not get filtered is secreted (purple arrows) into the kidney and adds to the urine composition. The distal nephron includes the distal convoluted tubule, the connector tube and the collecting duct. Its role is to adapt the quality composition of urine to the needs of the body(3). Finally mature urine is excreted out as shown by blue arrow.

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Albumin which has is a high molecular weight protein(69,000 daltons)and is negatively charged is not filtered by the kidney. However, if albumin is present in the kidney it is a sign that filtration is failing and is an indication of renal failure. Although, glomerular filtration rate (GFR) is the best measure of assessing renal function it is never done in routine settings.

CKD has been divided into 5 stages which is described below(1, 3):In lay man's term CKD can be described by a cartoon from Jorge Munitz published in www.medcomic.com

As shown in the cartoon CKD is divided into 5 stages and they are classified by glomerular filtration rate or GFR. Normal GFR is 90 ml/min but in stage-1, as shown in the cartoon the GFR is more than 90 ml/min. At this time the body is compensating and this can raise the GFR above normal levels which makes it very understand if the kidney is failing or not. In fact, most of the times CKD is diagnosed at late stage 2 or stage 3. This makes this disease difficult to diagnose and is a silent killer. When the GFR falls below 15 ml/min, dialysis or kidney transplant are the only resort left. This makes CKD a very expensive disease.

What are the potential complications of reduced GFR:

- Anemia
- High Blood pressure
- Decreased Calcium absorption can cause bone problems
- Dyslipidemia leading to atherosclerosis, ventricular hypertrophy, heart failure
- Hyperkalemia
- Hyperphosphatemia
- Metabolic acidosis
- Malnutrition

All the above features can become serious and not only is a part of CKD but can result in the development of other diseases. It is to be noted that most patients with CKD die from cardiovascular events such as heart failure.

Diagnostic Criteria of CKD:

Fraser and Blakeman have summarized the diagnosis of CKD from KDIGO (Kidney Disease Improving Global

Outcomes) guidelines and the English National Institute for Health and Care Excellence (NICE) guidelines(2). A patient is identified with CKD if abnormalities of kidney structure or function were present for a minimum of 3 months(2).The abnormalities are shown in the Table of Diagnostic criteria of CKD:

Diagnostic criteria for CKD

One of the following needs to be present for at least 3 months:

- 1) Decreased eGFR (<60 mL/min/1.73 m²)
- 2) One or more marker of kidney damage:
 - a. Albuminuria (urinary albumin-to-creatinine ratio [ACR] ≥30 mg/g [3 mg/mmol])
 - b. Structural abnormalities (from imaging)
 - c. Urine sediment abnormalities (hematuria, red or white blood cell casts, oval fat bodies or fatty casts, granular casts, and renal tubular epithelial cells)
 - d. Electrolyte and other abnormalities due to tubular disorders
 - e. Histological abnormalities
 - f. Previous history of kidney transplantation

Who are at risk for the development of CKD:

This is not an easy question to answer however, following conditions are huge risk factors for CKD.

- Diabetes
- Hypertension
- Acute kidney injury

- Cardiovascular disease (ischemic heart disease, chronic heart failure, peripheral vascular disease, or cerebral vascular disease)
- Structural renal tract disease, renal calculi, or prostatic hypertrophy
- Multisystem diseases with potential kidney involvement, for example, systemic lupus erythematosus
- Family history of end-stage kidney disease (GFR category G5) or hereditary kidney disease
- Opportunistic detection of hematuria

Again, it needs to be accentuated that everybody with the above conditions will not develop CKD. For example, just because someone has diabetes it is not necessary that the person develop CKD.

CONCLUSION:

CKD is an important multiplier of risk for many chronic noncommunicable diseases, including cardiovascular disease and cancer(5). In the United States alone, the health care costs for people with CKD requiring treatment for heart disease and other health problems made worse by their kidney disease exceeded \$60 billion in 2007(5). There is no cure for CKD and only treatment available is to control symptoms such as diabetes, hypertension, hyperkalemia etc. In this article I have not talked about maybe treatment and pathophysiology can be dealt about later. The only thing which needs to be emphasized is the fact that CKD is a silent killer.

REFERENCE

1. Bauer C, Melamed ML, and Hostetter TH. Staging of chronic kidney disease: time for a course correction. *J Am Soc Nephrol* 19: 844-846, 2008.
2. Fraser SD, and Blakeman T. Chronic kidney disease: identification and management in primary care. *Pragmat Obs Res* 7: 21-32, 2016.
3. Gueutin V, Deray G, and Isnard-Bagnis C. [Renal physiology]. *Bull Cancer* 99: 237-249, 2012.
4. Reddi AS. *Essentials of renal Physiology*. College Book Publishers, 1999, p. 336.
5. Ruggenenti P, Cravedi P, and Remuzzi G. Mechanisms and treatment of CKD. *J Am Soc Nephrol* 23: 1917-1928, 2012.