CARE for KIDNEYS™
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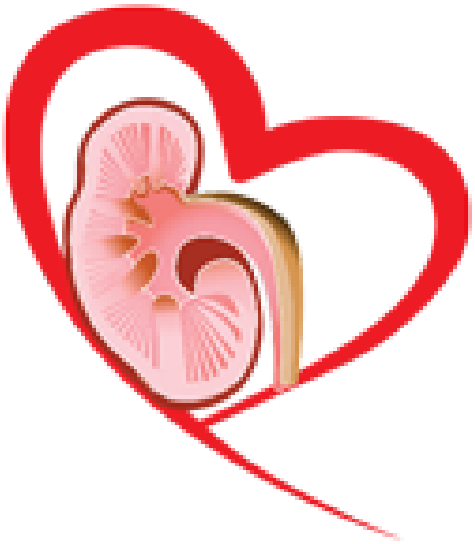
FOUNDATION

Kidney Care is at the Heart of our Foundation

CARE FOR YOUR KIDNEYS
Part I

A PATIENT'S GUIDE



Authors: Abdul-Rahman Ibrahim, Dr. A. Patel

Editor: Dr. A. Kadri

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ACKNOWLEDGMENT

I would like to thank all of those individuals involved in producing this educational book for patients. The printing of this educational booklet was made possible through the Care for Kidneys Foundation. The purpose of this booklet is to educate those patients living with and at risk for kidney disease so they can improve and maintain their health.

The Care for Kidneys Foundation is a non-profit charitable organization dedicated to improving the health and quality of life of patients living with kidney disease and those at risk of developing kidney disease. If you found this material helpful, please consider donating to this cause, so we can continue to provide material like this to patients in the future.

For more information on the Care for Kidneys Foundation and ways in which you can support the foundation please visit http://www.careforkidneys.org

Sincerely,

Dr. A. Kadri
Director,
Care for Kidneys Foundation.

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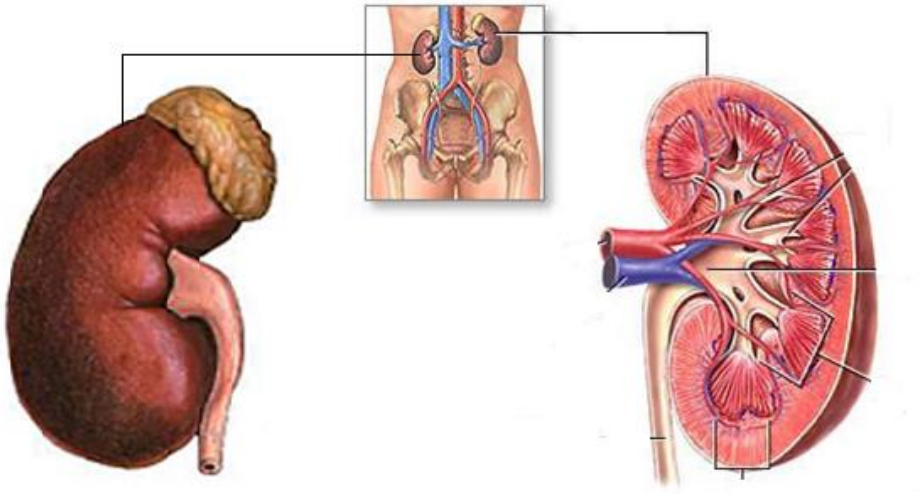
Chapter 1: What Is Normal Kidney Function?

Your kidneys have a number of important functions. They are responsible for fluid balance, control of electrolytes levels (salts in the blood), and elimination of waste products produced by your body. They also help in making Vitamin D, which keeps your bones strong. They are also involved in helping to make hemoglobin, which is a protein in your blood and helps to carry oxygen to your body.



Fluid Balance

The fluid you take in is used by your body and extra fluid that is not needed is eliminated by your kidneys by making urine. When your kidneys are healthy, they work to maintain the fluid in your body in a "balanced" state, so that fluid does not build up in your legs or lungs.

Control of Electrolytes

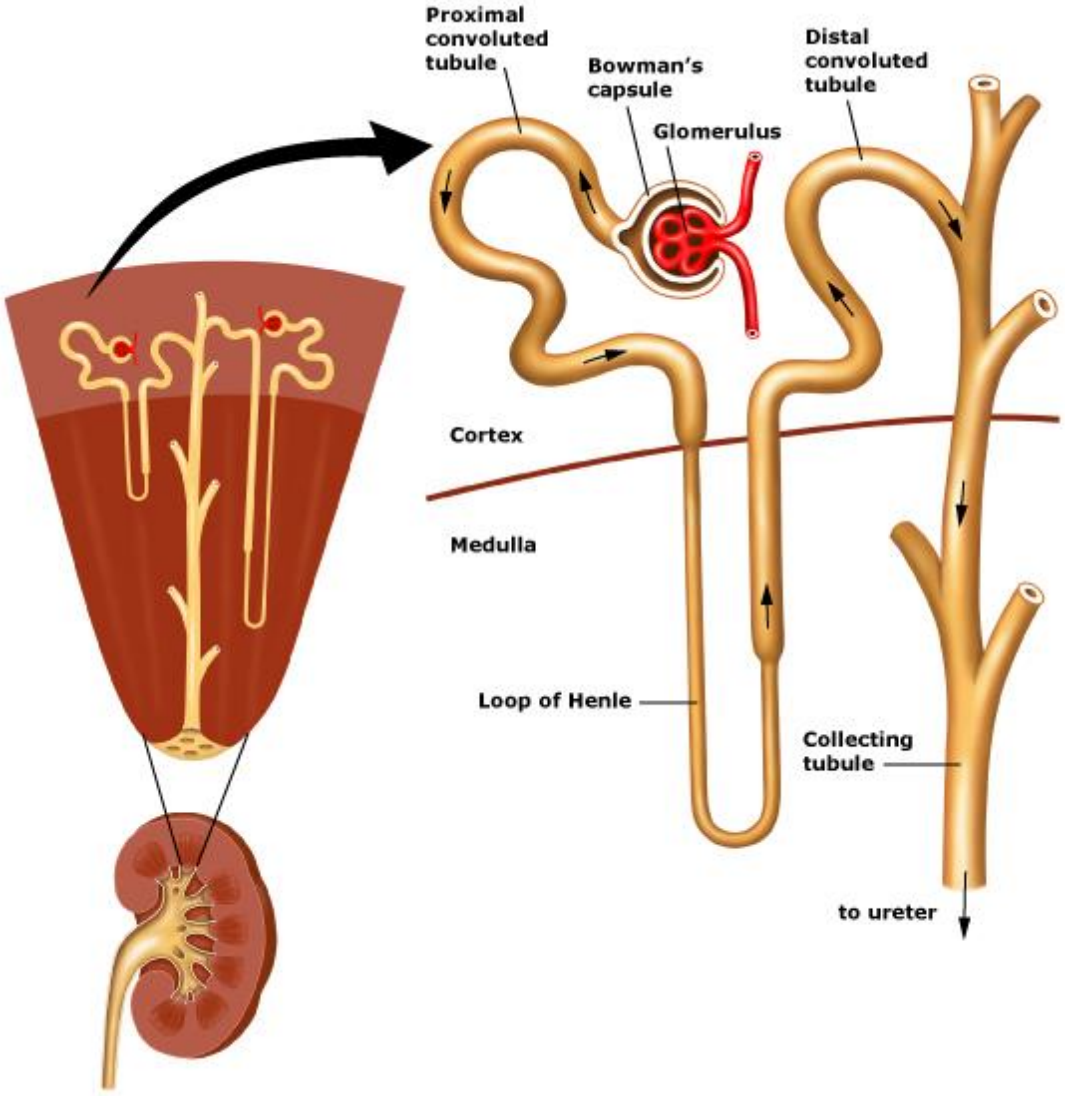
When you eat your body absorbs electrolytes which are found in cells and your blood stream. These electrolytes include sodium (found in table salt) and potassium. Your kidneys act as filters and get rid of extra electrolytes if there are too many in your body. Sodium levels also affect fluid balance in your body and excess sodium can cause you to retain fluid. When your kidneys are healthy, electrolytes and fluid remain in proper balance.

Elimination of Waste Products

The food you eat is used by your body for energy. When your body uses food for energy it creates waste products which are released into your blood. Your kidneys help to get rid of these waste products in your urine. There are two important products which are measured in your blood and help your doctor measure your kidney function. These are called creatinine and urea. When your kidneys are working properly both of these products are eliminated effectively in your urine and the levels of urea and creatinine measured in your blood remain **low.**

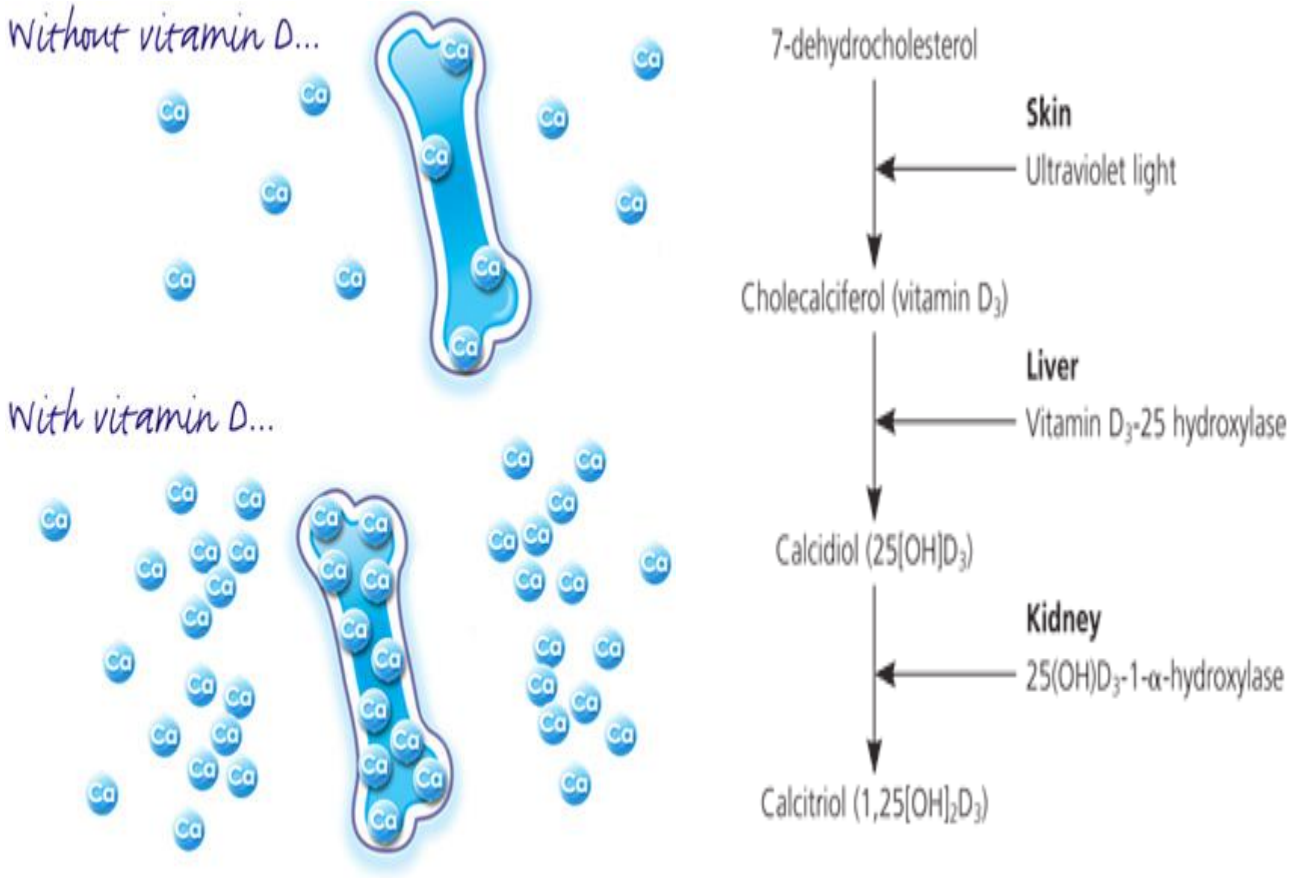
The filtering of electrolytes and fluid occurs at a microscopic level at the "nephron" which is the basic filtering unit of your kidney. Each

kidney contains millions of nephrons. Once filtered, urine is made up of salt, fluid and waste products, taken to your bladder through the ureter (tubes) and eliminated when you urinate. Below is a diagram of a nephron.



Vitamin D Production

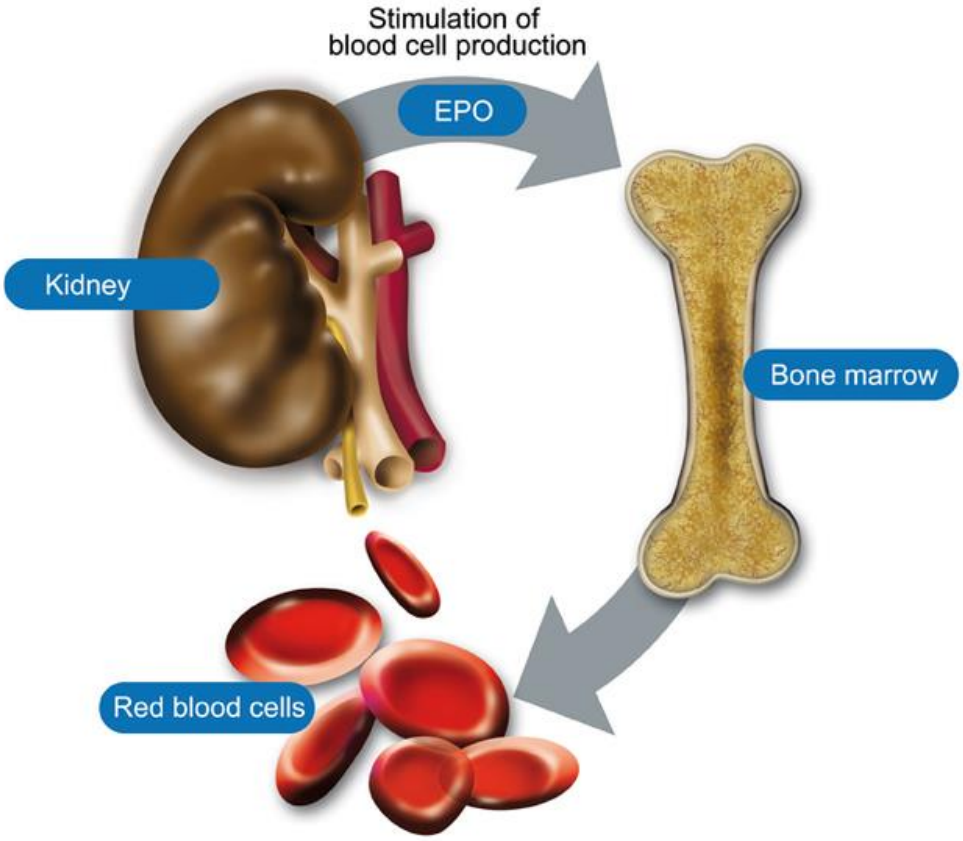
Your kidneys are extremely important in producing the activated form of vitamin D. Vitamin D starts out in an inactive form and later is changed to an active form. The two main sources of inactivated Vitamin D are through your diet, and production by your body when sunlight comes in contact with your skin. Vitamin D is important in balancing calcium levels in your blood and is important to maintaining strong bones. Inactivated Vitamin D is converted in your liver to another form. After this it is transported to your kidney to be converted again into the active form which helps balance calcium levels. When your kidneys work normally this conversion to active Vitamin D happens normally, but with kidney disease your kidneys may lose their ability to convert Vitamin D to the active form. This can put you at risk for bone disease. More details on the conversion of Vitamin D are in the following diagram.



Hemoglobin Production

Hemoglobin is a protein found in your blood. Hemoglobin is found in red blood cells. It is responsible for bringing the oxygen you breathe from your lungs to the rest of your body. Hemoglobin and red blood cells are produced in your bone marrow. The kidneys produce a hormone called erythropoietin. When the hemoglobin levels in your blood become low (a condition called anemia), your kidney produces erythropoietin. Erythropoietin tells the bone marrow to produce more hemoglobin to help carry oxygen in your body. When your kidneys work normally there is enough erythropoietin being released and your hemoglobin levels are maintained. When you develop advanced kidney disease you

may develop anemia because your kidneys do not produce this hormone in adequate amounts.

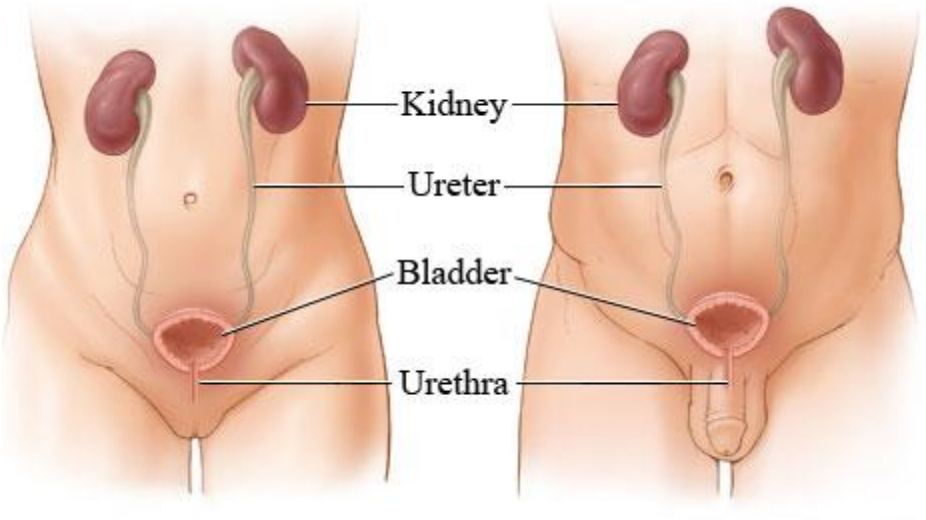


General Kidney Anatomy

Your kidneys are located in the lower back region on either side of your spine and are bean shaped. Normal kidneys approximately 9-12cm long, 6cm wide and 4cm thick.

The kidneys create urine as described in previous sections. The urine is carried down ureters. Ureters are tubes which carry the urine from your kidneys to your bladder. The urine is then stored there until enough urine builds up, at which point you get the urge to urinate. The

urine then leaves the bladder through the urethra, which is the tube that carries urine from your bladder to outside your body.



Chapter 2: How Is Kidney Function Measured?

Kidney function is most often measured by blood testing and sometimes urine testing. The most commonly used blood test to measure your kidney function is a serum creatinine level. Creatinine is released from muscles and enters into your blood. Your kidneys then remove creatinine from the blood and into the urine. **Therefore the lower the level of creatinine in your blood, the better your kidney function.** Because of the above, creatinine levels depend on both your muscle mass and your kidney function but in general a normal creatinine is approximately ≤ 100 μmol/L. Because muscle makes creatinine, people with higher levels of muscle mass tend to have higher creatinine levels in the blood, even with normal kidney function.

Kidney function can also be measured by collecting your urine for 24 hours and measuring how much creatinine is eliminated by your kidneys in a day. This test is not performed often, but may be needed.

Your physician may use a measurement called the glomerular filtration rate (GFR) to quantify how well your kidneys work. The GFR is the amount of waste your kidneys filter. A normal GFR is ≥90 ml/min/1.73cm3. The GFR is affected by age, body surface area, sex and race. Certain formulas are used by your physician to estimate your GFR taking into account the above factors and your creatinine level. This gives a measurement called the "estimated Glomerular Filtration Rate" or eGFR. This will calculate on average a value within 10% of your true GFR.

More advanced tests exist to accurately measure your GFR but these are rarely used and will be explained to you by your physician if needed.

Chapter 3: What Is Chronic Kidney Disease?

Chronic kidney disease (CKD) occurs when there is slow but progressive damage to your kidneys .This leads to reduced function and over time will cause your serum creatinine levels to rise. This is how your doctor can detect if you have chronic kidney disease.

There are five stages of chronic kidney disease. The stages of kidney disease are broken down according to GFR. Stage 1 is the least severe while stage 5 is the most severe. Any individual with persistent kidney damage is considered to have chronic kidney disease. This means you can still have chronic kidney disease with a normal GFR measurement (Stage 1). This is important to know so you can be monitored frequently to try and prevent further damage. The five stages of kidney disease are defined as follows:

STAGE 1: GFR ≥90 and other signs of kidney damage.

STAGE 2: GFR 60-89

STAGE 3: GFR 30-59

STAGE 4: GFR 15-29

STAGE 5: GFR <15 or on dialysis.

Chapter 4: How Do I Know If I Have Chronic Kidney Disease And Why Is It Important?

Chronic kidney disease in the early stages does not present with any symptoms. Therefore if you are at risk for kidney disease you should be monitored regularly. Patients considered at risk include those who have hypertension (high blood pressure), diabetes, a family history of kidney disease, and those with a previous episode of acute kidney injury or kidney failure.

Often the only way to know if you have CKD is through blood or urine tests your doctor can order. This does not mean that everyone needs a kidney test every year. But those at high risk should be monitored frequently. If you are worried about your kidney health, you should see your doctor for appropriate medical advice.

It is important to diagnose CKD in the early stages because this is when your physician can best treat you to prevent further damage. The earlier your disease is diagnosed and managed the better your chances for slowing progression and living free of dialysis in the future.

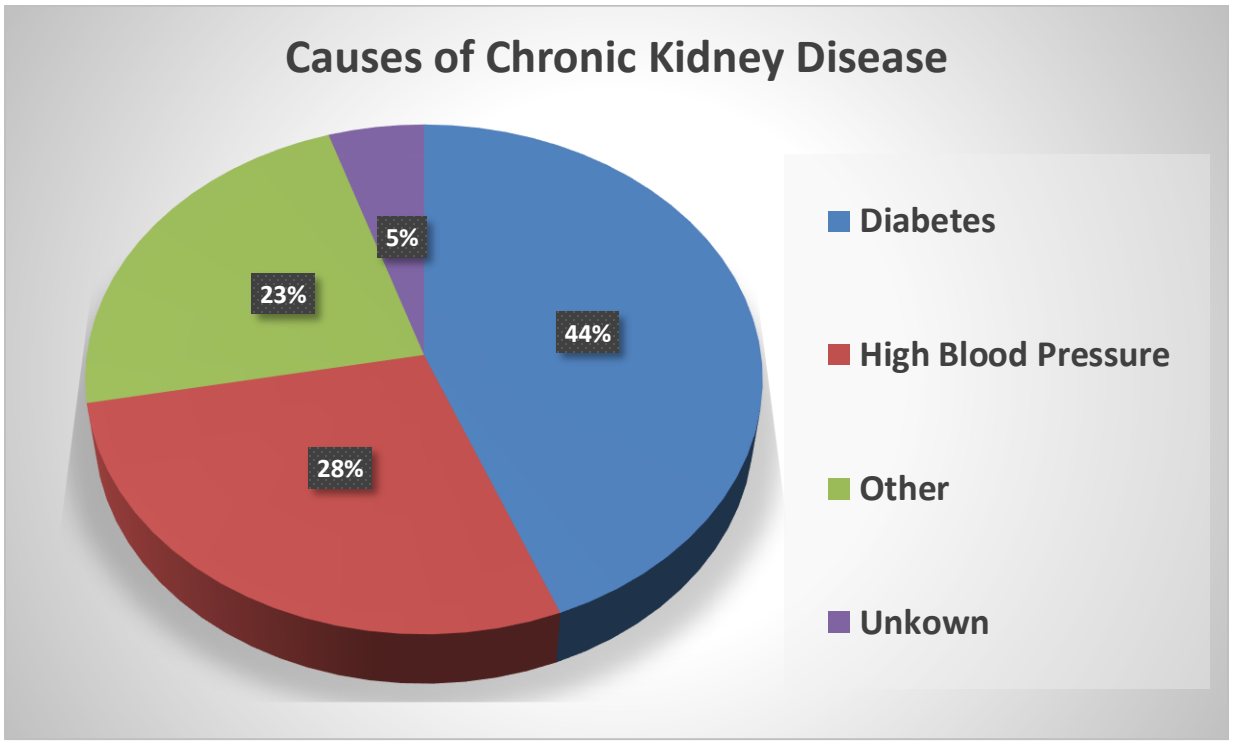
Patients with CKD also have an increased risk of cardiovascular disease (heart disease). It is important that you work with your physician to manage your kidney disease to the best of your ability to help prevent cardiovascular disease. Cardiovascular disease is the leading cause of death among patients with CKD.


Kidney Health Check
Blood Test
Urine Test
BP Check

Chapter 5: What Are The Causes Of Chronic Kidney Disease?

The majority of CKD worldwide is caused by hypertension and diabetes. These two diseases account for ≥ 70% of kidney disease leading to dialysis.

Other causes of CKD include auto immune conditions, genetic diseases and blockage of the bladder or ureters which prevents proper drainage of urine. A very small number of patients have CKD for unknown causes.



Chapter 6: What Are The Symptoms Of Chronic Kidney Disease?

It is important to note that most people with CKD have no symptoms at all. This is why it is important to see your family physician regularly and be monitored as needed depending on your risk category. If CKD continues to advanced stages (usually stage 4 and 5) without being detected you may get symptoms. These symptoms can include nausea, lack of appetite, itchy skin, severe fatigue, trouble concentrating, and fluid buildup in your lungs and legs (edema).

Patients suffering from CKD may also develop anemia. The more severe the stage of your chronic kidney disease, the more likely you are to experience anemia. This can lead to fatigue and shortness of breath.

Chapter 7: What Are The Complications Of Chronic Kidney Disease?

There are many complications of CKD. As kidney function declines you may develop a buildup of fluid, electrolytes and waste products in the body. Electrolytes (especially sodium) and fluid affect blood pressure, as a result you may have difficult to control hypertension. All of this together further increases your risk of developing cardiovascular disease and accelerates the progression of your kidney disease.

You may retain sodium and water which causes fluid to leak out into the tissue of your legs and cause swelling. It can also cause fluid to retain in your lungs causing shortness of breath.

One of the most serious complications of CKD is high potassium levels. The kidney is responsible for getting rid of potassium and high levels can lead to heart disturbances and even cause your heart to stop.

As the toxins and waste products build up in your blood, you may experience progressive lack of appetite and energy. This may lead to weight loss. Waste products can also cause itchy skin, confusion and rarely complications with your heart.

Because your kidney helps with vitamin D activation, long term problems with vitamin D can lead to weakness in your bones and a higher risk of broken bones.

Because your kidney's produce erythropoietin, which stimulates your bone marrow to make hemoglobin, you could lose this ability as your kidneys fail. This leads to anemia (low hemoglobin) which can cause fatigue, pale complexion and shortness of breath.

Chapter 8: What Tests Might My Doctor Order To Investigate My Chronic Kidney Disease?

Usually your chronic kidney disease will have been diagnosed by measuring your serum creatinine levels. If they are found to be elevated over time your doctor will diagnose you with CKD and search for a cause.

Your doctor will do routine blood tests to see if you have diabetes. They will also do a physical exam to investigate for hypertension. You will also go for an ultrasound of the kidneys. This is a non-invasive test which lets your doctor see pictures of your kidneys. This can give clues as to what is causing your chronic kidney disease, especially if it is caused by high blood pressure, or blockage of urine in your ureters or bladder. The ultrasound will also help look at the size and appearance of your kidneys.

Often your doctor will do tests to detect the presence of protein and blood in your urine. Under normal circumstances, there should not be significant amounts of blood or protein in your urine. If blood and protein are present, this will provide helpful clues to determine the cause of your CKD and how severe it is.

Chapter 9: What Diet and Lifestyle Changes Might Help My Chronic Kidney Disease?

There are many diet and lifestyle changes that can help with chronic kidney disease. Many of these depend on the cause of your kidney disease. If your CKD is due to diabetes, you will tailor your diet and lifestyle to keeping your blood sugar levels under control. If you have hypertension you will tailor your diet to lowering your blood pressure. Your doctor and a dietician can help tailor things to your particular situation but the following general measures below should be taken.

Blood Pressure Control

Regardless of what caused your chronic kidney disease in the first place, keeping your blood pressure under good control is important to slow down further damage to your kidneys. It is strongly advised that you obtain a blood pressure cuff to measure your blood pressure at home. You can record these readings and bring them to your doctor. They are the most accurate readings over time and will help you and your doctor work towards healthy blood pressure control.

An acceptable target blood pressure is generally between 130-150/90 or less based on the average of your monthly home readings. Your individual target depends on your age and whether or not you have diabetes etc. Check with your doctor about your individual target blood pressure.

Smoking

If you smoke, you should work with your doctor to quit as soon as possible. Smoking can not only lead to progression of kidney disease

but can also increase your risk of cardiovascular disease, poor lung function and cancer.

Diet

If you have high blood pressure you should work to reduce the amount of sodium in your diet. Sodium is often hidden in prepared and processed foods. Only 10% of the sodium you consume comes from table salt you add to food. The rest is hidden. You should read the packaging of anything you buy to evaluate how much sodium you take in. Also avoid adding table salt to food you make. You should aim for a sodium intake of ≤ 2g per day. Your doctor and dietician will help you work on this.

Once you are diagnosed with CKD your risk of cardiovascular disease increases. For this reason you should adjust your diet to lower your risk of heart disease. This includes eating plenty of fruits and vegetables, and reducing the amount of fat and cholesterol in your diet.

	Choose and prepare foods with less salt (sodium). Use less salt at the table.
	Select the right kinds and smaller amounts of protein.
	Choose foods that are healthy for your heart, like lean cuts of meat, skinless chicken, fish, fruits, vegetables, and beans.
	Read the Nutrition Facts Label, especially for sodium, to help you pick the right foods and drinks.

Weight Loss

If you are overweight, you should try to reduce your weight in a healthy manner. Please see your physician for advice on how to do this, but for the most part this includes healthy eating and regular exercise. Being overweight will increase your risk for diabetes, high blood pressure and cardiovascular disease. Diabetes and high blood pressure may further damage your kidneys. It is important to avoid crash or fad diets as they may leave you dehydrated and cause further kidney damage.

Exercise

Exercise has many benefits including lowering blood pressure, weight loss and increasing cardiovascular fitness. It is important you maintain heart healthy exercise on a regular basis. This includes 30-60 minutes of moderate intensity exercise 5-7 times per week.

Hydration

When your kidney disease is early (stage 1-3, your kidneys will usually not have trouble getting rid of extra fluid. But becoming dehydrated and having too little fluid can harm your kidneys further. For this reason it is important you do your best to stay well hydrated with water in the early stages of kidney disease. Energy drinks sometimes contain excess salt which can lead to fluid retention causing edema and increase your blood pressure. For this reason it is best to maintain your hydration mostly with water.

If your kidney disease progresses to advanced stages you may run into problems with retaining sodium and fluid. This may cause swelling, and at that point your doctor may give you more specific advice about hydration.

Healthcare Visits, Medications and Tests

It is important that you see your doctor regularly. Continuous monitoring is essential for maintaining your kidney health. It is important to also be adherent with all medications prescribed by your doctor. If a particular medication is not working for you then discuss it with your doctor for alternatives.

Certain medications can harm your kidneys. Let all physicians you see know you have kidney disease when they are prescribing you new medications. Also be careful of over the counter medications as some can harm your kidney if you have chronic kidney disease. Plain Tylenol is safe in recommended amounts. Discuss any other over the counter medications with your physician before use if you have chronic kidney disease.

Sometimes you may need to go for a medical test which requires "dye" to be injected into your blood stream. If this is the case please let your physician know you have a kidney problem prior to your test.

Chapter 10: How Should My Kidney Function Be Monitored?

Most often, your kidney function is monitored with routine blood and urine testing. Rarely a 24 hour collection of your urine will be needed. These tests will help your doctor monitor your kidney function.

You should meet with your physician regularly to go over the results. If your blood or urine tests show signs of worsening, this may be an indication that your kidney disease is progressing.

If your kidney disease is progressing you may be referred to see a nephrologist (kidney specialist). The nephrologist will work with you to help try and improve or prevent further damage to your kidneys.

Chronic kidney disease may not be curable, but there are many things that can be done to stabilize your kidney function and slow down the progression of future kidney damage. Further damage can often be prevented and help keep you healthier and delay the need for treatments such as dialysis. This is why it is extremely important to be adherent to your medications, and your appointments with your doctors to slow down the progression of your kidney disease as much as possible. With proper management it is possible for you to live a healthy and fulfilling life with chronic kidney disease.

Chapter 11: When Should I Be Concerned About My Kidney Function?

You should be concerned about your kidney function at any level of kidney disease. Once you are diagnosed with chronic kidney disease, you should take as many measures as possible to help prevent further damage to your kidneys. The more advanced your disease, the more things you may have to do. Your doctor and healthcare team will work with you to help you with this process.

As kidney disease advances you will require more frequent monitoring with blood work and more frequent visits to see your physician. At this point you will likely be seeing a nephrologist as well. They will work with you to help prolong the life of your kidneys as long as possible and talk to you about the use of medications to help with your kidney disease. If your disease becomes advanced enough your physician will talk to you about dialysis or kidney transplantation.

All of these changes can be difficult so it is important that you are involved and educated when you are diagnosed with chronic kidney disease. If you start to develop signs of swelling, fatigue, decreased appetite, itchy skin, nausea and vomiting, confusion, or significant shortness of breath, you should let your physician know immediately.

Chapter 12: When Do I Need To See A Specialist For My Chronic Kidney Disease?

There is no set level of chronic kidney disease when you should see a specialist. Often your family doctor will refer you when they would like input about your management plan. You may always request to see a kidney specialist through your family doctor if you are concerned.

After seeing a specialist they may make recommendations to your family doctor and only follow up with you if there is a problem or your kidney disease advances. Other times the kidney specialist will continue to follow you on an ongoing basis. Your kidney specialist and family doctor will work together closely to meet your needs.

As you develop Stage 3 or higher disease you will be followed by a specialist regularly to make sure you are being monitored frequently, started on appropriate medications as needed and prepared for dialysis or transplantation if needed in the future. Often kidney specialists will run clinics with other healthcare professionals including nurses, dieticians, social workers and pharmacists who will all help contribute to your kidney well-being.

Glossary and Abbreviations

Anemia – A condition where hemoglobin levels in your blood are low. Symptoms may include fatigue, extremely pale complexion and shortness of breath.

Bone Marrow – The factory where hemaglobin and blood cells are made. The bone marrow is located inside your bones.

Chronic Kidney Disease (CKD) – A condition in which there has been progressive, irreversable damage to your kidneys. There are five stages of chronic kidney disease. The most common causes are hypertension and diabetes.

Creatinine – A waste product of muscles which is measured in your blood. Creatinine is eliminated by your kidneys. For this reason the level of creatinine in your blood helps your physician determine how well your kidneys work.

Diabetes – A condition which causes high blood sugar levels. Over time high sugar levels can damage your kidneys. Diabetes is the leading cause of chronic kidney disease.

Dialysis – This is a form of therapy which helps to replace the function of your kidneys when they cannot work well enough anymore. This is usually considered when you have Stage 5 kidney disease. There are many types of dialysis therapy which will be discussed in other educational booklets.

Edema – This is the abnormal build up of fluid in your tissues. This can lead to swelling if fluid build up is in the legs or arms. It can lead to shortness of breath if fluid build up occurs in your lungs.

Electrolytes – These are substances found in your body. They include sodium and potassium. They are essential for your body to function but have to be kept in proper balance. Your kidneys work to perform this function.

Erythropoietin – This is a hormone produced by your kidney which helps to keep the hemoglobin levels in your blood steady. This hormone tells the bone marrow to produce more hemoglobin.

Glomerular Filtration Rate (GFR) – A measure of how well your kidney filters waste. This depends on age, sex, race, body surface area, and creatinine levels. When calculated using a formula it is referred to as an eGFR (Estimated Glomerular Filtration Rate).

Hemoglobin – A protein found in the blood, which carries oxygen from your lungs to the rest of your body.

Hypertension – This is a disease of high blood pressure. High blood pressure over time can cause damage to your kidneys and can leads to chronic kidney disease, heart and vascular disease as well as stroke.

Nephrologist – A specialist who diagnosis, evaluates, and manages patients with kidney disease.

Nephron – The basic filtering unit of the kidney. Your kidneys contain millions of nephrons.

Urea – A waste product produced by your body when it uses energy. This waste product is eliminated by your kidneys.

Ureter - The tube which carries urine after it is made in your kidneys. Your ureter carries urine from the kidney to the bladder.

Urethra – This is the tube which carries urine from the bladder to outside your body.