

Lucile Packard Children's Hospital at Stanford

You and Your Kidney: Living with Chronic Kidney Disease

[Division of Pediatric Nephrology]

LPCH
[10/22/2009]

My CKD Information Sheet

MY KIDNEY DISEASE IS: _____

MY NEPHROLOGIST IS: _____

MY NURSE IS: _____

MY PHARMACY IS: _____

MY LABORTORY IS: _____

MY PRIMARY CARE DOCTOR IS: _____

MY DIETICIAN IS: _____

MY SOCIAL WORKER IS: _____



Pediatric Nephrology Division

Stanford University Medical School and Lucile Packard Children's Hospital

Attending Physicians:

**Steven R. Alexander MD
Minnie Sarwal MD
Cynthia J. Wong MD**

**Paul Grimm MD
Scott Sutherland MD**

**Donald Potter MD
Elizabeth Talley MD**

Pediatric Fellows:

**Abanti Chaudhuri MD
Lieuko Nguyen MD**

**Rouba Garro MD
Brad McClellan MD**

Maria Caimol MD

Nephrology Nurse Coordinators:

Lonisa McCabe RN, CNN

Gina Ragsdale RN

Dialysis Nurse Coordinators:

Brandy Begin RN, CNN

Kari Salsberry RN, CNN

Cathy Cagen RN, CNN

Nephrology Patient Care Coordinator:

Irene Fantozzi

Social Worker:

Meg Dvorak MSW

Nephrology Dietician:

Sabrina Martinelli RD

Child Life Specialist:

Kirsten Cotton-Sheldon CCLS

770 Welch Road Suite 300 Palo Alto, CA 94304

650-724-0353 phone

650-721-6685 fax

For Appointments:

650-724-0353

CKD rules to follow:

DO **NOT** take IBUPROPHEN, MOTRIN®, ADVIL® or any other medications that might contain these ingredients. Acetaminophen or TYLENOL® is ok to take for fever or pain.

IBUPROPHEN can decrease the blood flow to the kidneys and put the kidneys at risk for damage.

DO **NOT** take PSEUDOPHEDRINE, SUDAFED® or any other medications that might contain these ingredients. This includes most cold medications that have decongestants.

PSEUDOPHEDRINE can increase blood pressure.

If any doctor wants to perform testing (such as a CT or MRI scan) that involves using CONTRAST, tell the doctor to **talk with your nephrologist first**.

CONTRAST can be hard for damaged kidneys to get rid of. Your nephrologist can help your doctor decide what would be a better way to perform the test.

If you or your child **makes a lot of urine** and goes to the bathroom more than usual, it is important to **drink a lot of fluid** during the day. Your nephrologist will tell you how much you or your child should drink per day to keep your kidneys healthy. Talk to your nephrologist if you have questions about this.

If your doctor prescribes you a **new medication**, **call your nephrologist** to see if it is ok for your kidneys. Always remind your doctor when giving you a new medicine that you or your child has a kidney problem.

It is important to have lab work done. It gives your nephrologist important information about how the kidneys are doing. Your nephrologist will tell you how often lab work needs to be done.



Chronic Kidney Disease

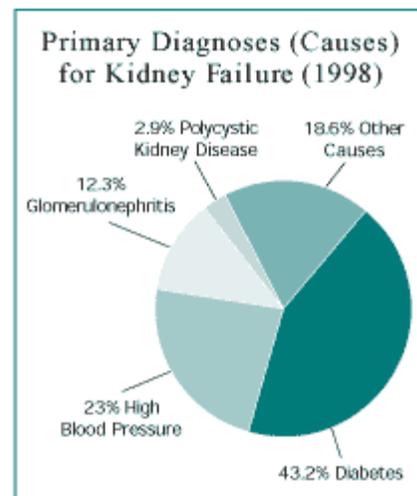
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Chronic Kidney Disease, what does that mean? Chronic kidney disease, also called **CKD**, means that the kidneys are not working properly. They have been damaged in some way and will stop working over time. This may happen very slowly (over many years), or it may happen very fast (over months). Your kidney doctor, called a nephrologist, will be able to explain to you when this is **likely** to happen based on what caused the kidney damage. CKD must be followed by a nephrologist over a lifetime.

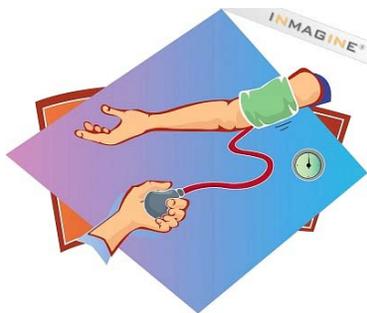
What causes chronic kidney disease? Chronic kidney disease usually occurs as a result or problem of the following illnesses or injuries:

- **Obstructive nephropathy:** Disorders that block urinary flow such as kidney stones, enlarged prostate, or tumors. The backflow pressure on the kidneys causes loss of function.
- **Kidney disease:** This may include glomerulonephritis (glo-mer-u-lo-ne-fri-tis), kidney infections, cystic kidney disease, or tumors (cancer).
- **Autoimmune disease:** This may include systemic lupus erythematosus or lupus. Lupus may cause swelling in all organs of the body, including the kidneys.



The most common cause for kidney failure in children is obstructive nephropathy or kidney disease. Your child may also have kidney disease due to a strong family history of kidney problems, high blood pressure or diabetes. Certain ethnic groups are also more likely to have kidney disease. African Americans are nearly four times as likely to develop kidney failure as white Americans. American Indians have nearly three times the risk compared to whites. Hispanic Americans have nearly twice the risk of non-Hispanic whites.

How is Chronic Kidney Disease diagnosed?



In the early stages of CKD people generally don't feel sick. Kidney disease is often discovered when a person starts to feel sick. Kidney disease can be detected with simple tests. The first test is for high blood pressure and this done at the doctor's office. If blood pressure is high all the time, it can lead to CKD. Or high blood pressure may be a signal that kidney damage has already happened. Normal blood pressure values are based on your child's height and age.

Another way of diagnosing CKD is by looking at creatinine. Creatinine is a waste product that comes from the breakdown of muscle. If the kidneys are not functioning well, high levels of creatinine will be in the bloodstream. A high creatinine level may be a sign of kidney disease. Normal levels of creatinine are based on a person's body size.



Another sign of CKD is protein in the urine. Protein is sometimes called albumin. A high level of protein in the urine is called proteinuria. Proteinuria can be detected by a simple urine test. If the urine test shows

that there is a high protein level it means that the kidney is unable to hang on to the proteins your body needs. The kidney will leak the proteins into the urine. A first morning urine test called a protein-to-creatinine or albumin-to-creatinine ratio is also used to determine CKD. Healthy kidneys take creatinine from the blood and get rid of it in urine. This test will measure the amount



of protein and creatinine from the urine and will signal if it is too high. A protein-to-creatinine ratio greater than 0.2 mg/dL or an albumin-to-creatinine ratio greater than 30 mg/dL is an abnormal result. Urine protein, or urine albumin, levels are continually followed by a nephrologist.

Stages of Chronic Kidney Disease

Chronic kidney disease has five stages. Each stage is determined by how well the kidney is working. By looking at creatinine values and using a mathematical formula the nephrologist will be able to tell what stage of CKD someone has. This calculation gives a number called the estimated

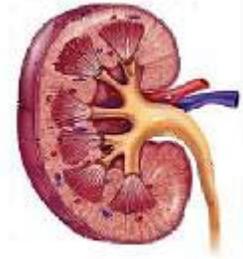
glomerular filtration rate or eGFR. The eGFR number corresponds with the stage of CKD.

Stage CKD	eGFR
1	>90
2	60-90
3	60-30
4	30-15
5	<15

Stage 1 is normal kidney function. When a person's eGFR stays at stage 2 for three months or longer it is considered chronic kidney disease or CKD. Stage 3 is moderate CKD. At this stage symptoms of kidney disease, such as anemia and bone disease, start to show. These symptoms

will be prevented or treated by the nephrologist. Stage 4 is severe kidney disease. At this stage you may notice more symptoms of kidney disease. Other symptoms include:

- **Urinating more or less**
- **Decrease in appetite or nausea and vomiting**
- **Feeling more tired**
- **Difficulty concentrating or remembering things**
- **Swelling in the hands and feet**
- **Muscle cramps**
- **Tingling in the hands or feet**
- **Itching**
- **Darkened skin**



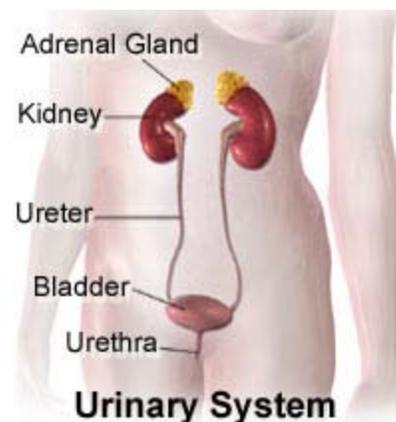
Symptoms continue to be treated by the nephrologist and future treatment for kidney disease is discussed. Stage 5 is called end stage renal disease. This means that the kidneys are no longer working. At this stage treatment for kidney disease is started. This treatment will either be dialysis or kidney transplant.

What Does the Kidney Do for You?

The kidney is a complex organ in the body. Most people would say that the kidneys “make urine”. This is correct, but the kidney does much more. Most people are born with two kidneys, but some people only have one. Someone with one kidney can live a long healthy life. The kidneys are two bean shaped organs about the size of a fist and are located near the back of the spine, behind the stomach, and under the rib cage. Each kidney has a tube draining from it called a ureter. The ureter moves urine from the kidney and takes it to the bladder. From the bladder the urine drains through a tube called the urethra. The urethra eliminates the urine through a male’s penis or a female’s vagina.

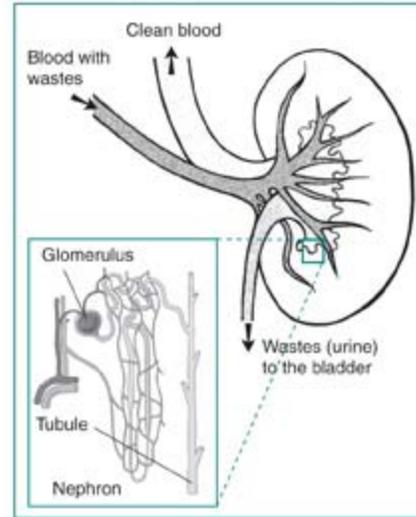
The jobs of your kidney are:

- **Remove waste from your body**
- **Balance body fluids**
- **Remove drugs from the body**
- **Regulate your body’s electrolytes and acids**
- **Control blood pressure**
- **Control production of red blood cells**
- **Produce an active form of vitamin D to produce healthy bones**
- **Plays an important role in growth**



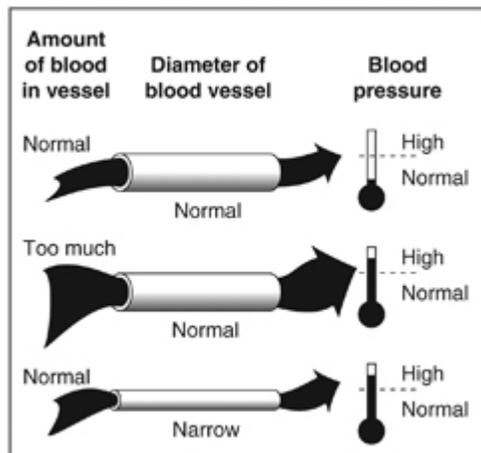
Waste Removal and Fluid Balance

The first job the kidney does is getting rid of the waste and fluid the body makes by turning it into urine. This waste is also called urea. Urea is measured by a blood test called BUN. A high BUN level means the kidneys are not able to remove the body's urea or waste. Urea comes from the breakdown of food and tissues such as muscle. The body absorbs the nutrients from the food and then the blood takes the urea to the kidneys. Urea can make the body very sick if not removed from the bloodstream. Each of the kidneys has about a million filters called nephrons. As blood moves through the kidneys, nephrons remove the urea and turn it into urine. A chemical exchange takes place as urea and extra fluid leave your blood and becomes urine. During this process kidneys also reabsorb chemicals and minerals such as sodium, potassium, calcium, phosphorus and acid to help regulate your body's balance. They also keep protein and cells your body needs and returns it to the bloodstream. When those nephron filters are damaged they don't do a good job of removing the waste and fluid or absorbing the chemicals and minerals the body needs. You may have swelling in your hands and feet and you may not urinate as much as you used to if the nephrons become badly damaged. Eventually badly damaged nephrons will no longer be able to get rid of the urea and fluid. Over time, damaged kidneys may stop working all together.

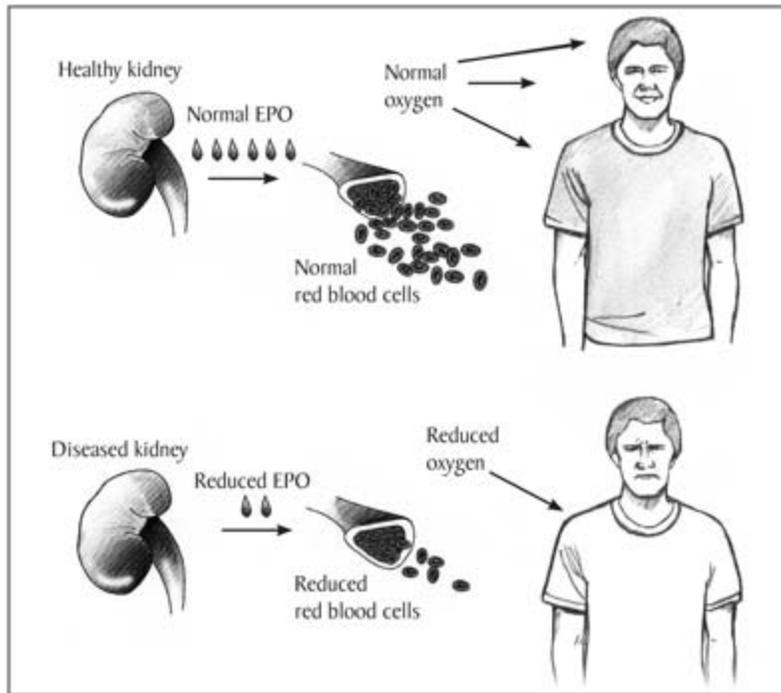


Blood Pressure Control

Blood pressure is the force of blood against the body's blood vessels. Extra fluid in the body increases the amount of fluid in the blood and causes blood pressure to be high. Narrow, clogged or stiff blood vessels also make blood pressure high. High blood pressure is called hypertension. Hypertension makes the kidneys and heart work much harder than they should. Over time high blood pressure can damage all of the vessels in the body. If the vessels in the kidneys are damaged they will not be able to get rid of extra body fluid. This will then increase blood pressure also. It is a dangerous cycle. The kidneys are a powerful chemical factory and



produce chemicals or hormones for your body to keep blood pressure normal. Renin is the hormone made by the kidneys to help keep blood pressure normal. Renin will work with other chemicals to tell the blood vessels to increase blood pressure when it gets too low. Renin also works with other chemicals to hold on to salt and water to help keep blood pressure normal. When the kidneys aren't able to get rid of salt and water the blood pressure rises. It is very important to keep blood pressure under control. High blood pressure may lead to heart disease.



Red Blood Cell Production

The kidney also produces erythropoietin. Erythropoietin, or EPO, tells the bone marrow in the body to make red blood cells. Red blood cells are important because they transport oxygen to the body's tissues and vital organs such as the heart and brain. With CKD the kidneys do not produce enough EPO to meet the body's demands. If the body does not produce enough red blood cells a condition called anemia

occurs. Symptoms of anemia include feeling tired and looking pale.

Kidneys and Healthy Bones

In order for bones to grow and stay strong the body needs calcium, phosphorus, and vitamin D. Calcium and phosphorus are the minerals we get from many foods, such as milk and dairy products. Calcium is also found in green leafy vegetables, orange juice, beans, whole grains and fish. Calcium is the most common mineral in the body and phosphorus is the second most common. Phosphorus is found in some meats, beans, colas and other soft drinks, pancake mixes, chocolate, and nuts. Vitamin D is found in most dairy products. The kidneys play an important role in keeping bones healthy by balancing blood calcium and phosphorus levels.

If calcium levels in the blood get to low, glands in the neck called the parathyroid will release a hormone called parathyroid hormone (PTH). This hormone draws calcium stored in the bones to increase the calcium level in the blood. Too much PTH in the blood will cause too much calcium loss from the bones. This constant removal of calcium from the bones will cause the bones to weaken over time.

Phosphorus helps regulate calcium levels in the bones. Healthy kidneys will be able to get rid of the extra phosphorus in the blood. When the kidneys aren't working well, phosphorus levels become too high and that will lower calcium levels in the blood. The low calcium levels in the blood will signal for more PTH to take calcium from the bones. The kidneys are forced to work harder to get rid of the extra phosphorus even before the levels of phosphorus get elevated in the blood.

Healthy kidneys will produce the hormone calcitriol from vitamin D that comes from the sun to help build bones. Calcitriol helps bones absorb the right amount of calcium for the blood. Calcitriol and PTH work together to keep calcium levels in check so that bones get stronger. In a person with chronic kidney disease the kidneys don't make calcitriol. The body won't be able to absorb calcium from food and the body will have high levels of PTH. This combination will make brittle and weak bones.



Growing with CKD

Children with CKD may have trouble growing to their full potential. Growth hormone is produced by the pituitary gland to make sure our bodies grow. Some people with CKD grow well, but some do not. The kidneys play an important role in the growth of children. They help regulate the amount of nutrients from food including calcium, phosphorus and vitamin D. These nutrients are very important for growing children. If the kidneys are not able to regulate these minerals, bones will not grow and people with CKD may be shorter than they should be. The kidneys also regulate acid in the blood. If this balance of acid is too high it promotes poor growth. Most children with CKD have normal growth hormone levels but are not able to grow well because their bodies aren't able to use the growth hormone correctly. A medication called growth hormone (Nutropin®) can help children with CKD grow properly. Tracking the growth of a child is important. Nephrologists will follow growth by looking at a growth chart. This growth chart will show how well a child with CKD is growing compared to other children. The goal for a child's growth is to fall somewhere in between the height of mom and dad. A nephrologist will mention the need for growth hormone if a child is not growing properly.



Medications and CKD



As you have read, the kidneys play an important role in keeping the body healthy. As kidney function worsens medications may be prescribed to take over the jobs of the kidney. In the early stages of CKD a person may start by taking one or two medications. But as one approaches the later stages, more medications will be introduced. There are 6 classes of medications used in CKD.

These medication classes are:

- ACE inhibitors or ARBS
- Antihypertensives
- Phosphorus Binders
- Vitamin D supplements
- Treatments for Anemia
- Alkaline agents

ACE inhibitors and ARBS

ACE inhibitors and ARBS help the kidneys in two ways. First they help the kidney from spilling protein in the urine. Excess protein in the urine means that there is scarring in the kidney's filtering system. This scarring, overtime, will eventually get worse and ACE inhibitors and ARBS can help slow this process. They also help lower blood pressures. In the early stages of CKD, ACE inhibitors and ARBS are used. The two common ACE inhibitors used are enalapril (Vasotec®) or lisinopril (Zestril®). Some of the side effects of ACE inhibitors are:

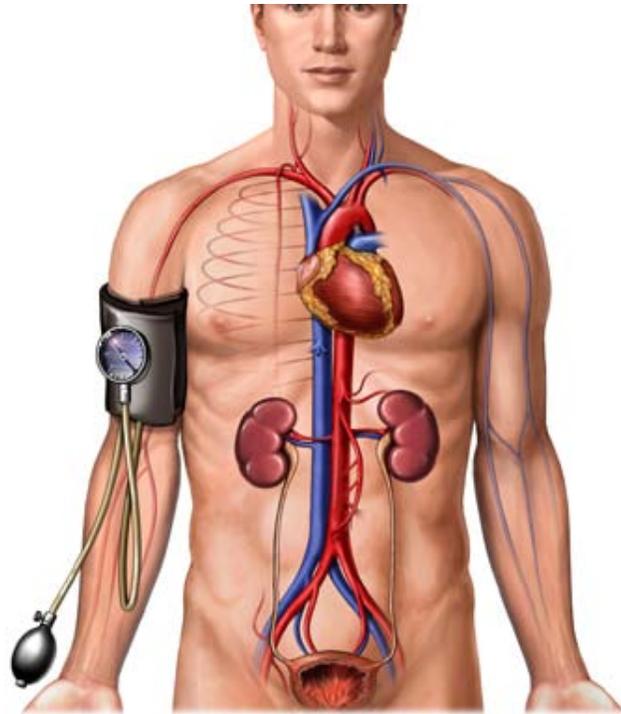
- High blood potassium levels
- Low blood pressure
- Decreased blood flow to kidneys
- Chronic cough

These potential side effects are very important to look out for. Your nephrologist will want to monitor blood and urine tests frequently and will want to be notified if you or your child has any symptoms of low blood pressure such as dizziness or fainting. It is important to drink lots of fluids while taking an ACE inhibitor. If a person is ill and not able to drink fluids (such as with the

flu) the nephrologist will need to be notified. If someone does not tolerate the use of ACE inhibitors, ARBS will be used. The most common ARB used is losartan (Cozzar®).

Antihypertensives

Antihypertensive medications help control high blood pressure. There are many different classes of antihypertensive medications because they act on the body in different ways to achieve normal blood pressures. Sometimes more than one blood pressure medication will need to be used to help lower blood pressure. The nephrologist will want blood pressures to be taken at home and recorded in a journal. When taking medications that

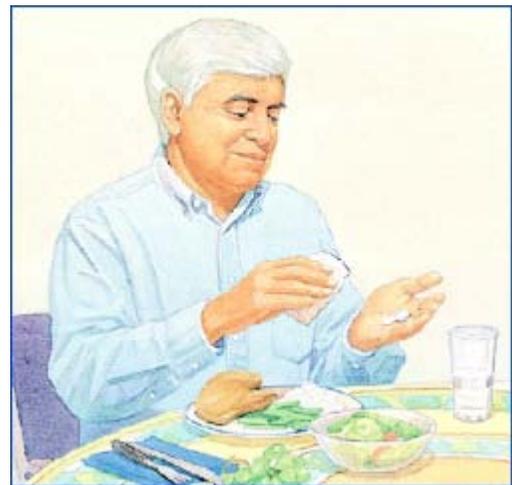


help lower blood pressure it is important pay attention to how one is feeling. Feelings of dizziness or fainting could mean that the blood pressure is too low. A severe headache that won't go away it could mean that blood pressure is too high. It is best to take a blood pressure if one is not feeling well. Call the nephrologist if it is out of range. The nephrologist will notify what range the BP should be. The most common medications prescribed to control blood pressure are: Atenolol (Tenormin®), Amlodipine (Norvasc®), Clonidine (Catapres®), Isradipine (Dynacirc®), and hydrochlorothiazide (Microzide®). These medications have similar side effects of: low blood pressure, dizziness and feeling sleepy.

Phosphorus Binders and Vitamin D

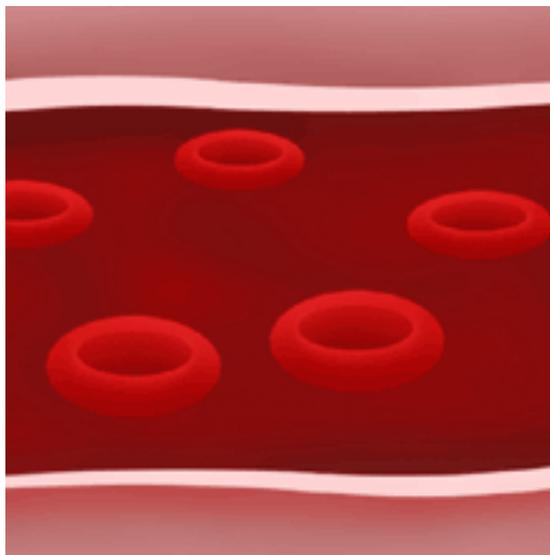
Phosphorus Binders, such as calcium carbonate (TUMS®), calcium acetate (Phoslo®), and sevelamer (Renagel®), are used to help control high levels of phosphorus. Controlling high levels of phosphorus helps to prevent damage to bones. It is important to take phosphorus binders **WITH FOOD**. By taking phosphorus binders with food, they bind the calcium absorbed from food in the gut and help prevent the calcium from being absorbed into blood. Phosphorus binders are like a sponge that will suck up the excess phosphorus from foods so it doesn't go into the blood stream.

Vitamin D in the form of calcitriol (Rocatriol®) is given when the kidneys are no longer able to make it. Calcitriol is needed to help reduce high levels of PTH so the body can regulate the balance of calcium and phosphorus.



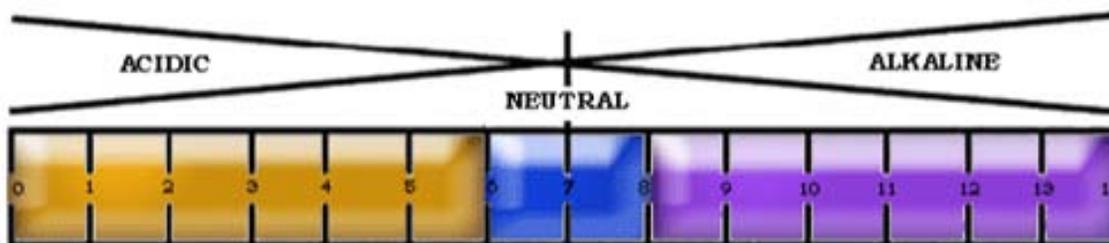
Treatments for Anemia

When kidneys don't produce enough erythropoietin a condition called anemia occurs. This is due to low red blood cell counts and low iron levels. Anemia is treated first by taking iron orally. Iron is a mineral that is found in protein rich foods such as red meat. It is used to help build red blood cells so they can transport oxygen to the body. Common supplements used to treat anemia are over the counter ferrous sulfate and Slow Fe®. When taking oral iron medications, dairy products such as milk, yogurt and cheese, should not be eaten within two hours of taking iron. If iron supplements are not enough to make the red blood cells strong, epoetin (Epogen® or Procrit®) injections are used. Epoetin is a man made form of the erythropoietin kidneys produce. Often times iron and epoetin are used together. Sometimes folic acid and vitamin B 12 are added in the form of a prescription vitamin (Nephro-Vite®) to help boost iron levels. Once anemia is treated people feel like they have more energy. If anemia is not treated, low red blood cell counts can affect other organs such as the heart and brain.



Alkaline Agents

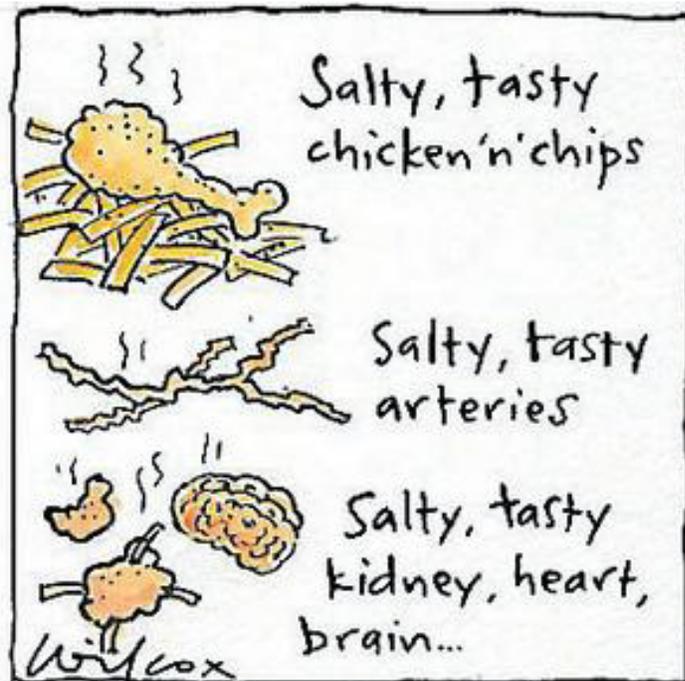
The cells in your body use chemical reactions to carry out jobs such turning food into energy and rebuilding tissue. The result of these reactions is acid. The body needs some acid to be balanced, but too much acid causes problems. Acidosis happens when the kidneys no longer get rid of acids into the urine. Too much acid in the blood can cause a slowing of growth, kidney stones and weak bones. Healthy kidneys help balance acid in the blood by getting rid of it in the form of urine and exchanging it for bicarbonate. Bicarbonate is a substance that prevents the buildup of acid in the blood from the body's numerous chemical reactions. When kidneys stop working properly a supplement called sodium bicarbonate is used to help lower the high acid levels in the blood.



Nutrition, Exercise and CKD

The first (**and best**) line of defense in keeping the body happy with CKD is making good life choices. This means eating a healthy diet, exercising and treating your body well by not smoking, taking illegal drugs or drinking excessive alcohol. It is very important to maintain a healthy weight with CKD. Having extra weight on your body causes stress to your kidneys and heart. Having extra weight the body doesn't need causes the kidneys and heart to work harder. If the damaged kidneys' are working harder than they should, they will stop working sooner rather than later. It is important to save what

function damaged kidneys have now. This means that an exercise routine is needed every day. When exercising, one should work up a sweat for at least 30 minutes. Exercise not only makes a person feel good, it sheds extra weight, lowers blood pressure and cholesterol. So go out and walk, run, play basketball, swim, whatever you like!



Living with CKD poses some challenges. One of these challenges is eating a kidney friendly diet. A diet high in salty foods can cause problems for the kidney by causing high blood pressure. A low sodium (salt) diet may be needed. A nephrologist can give guidelines of how much salt should be restricted per day. Generally it should be less than 1000 milligrams or no higher than 2000 milligrams per day. It is important to read the labels of food to see how much sodium is in it. Processed foods contain a lot of salt and these foods will need to be limited. Foods and meals that are made at home are the best to monitor how much salt is used. Fresh fruits and vegetables are the best snack food options. A dietician can give more information about a kidney friendly diet.

At A Glance: High Sodium Foods

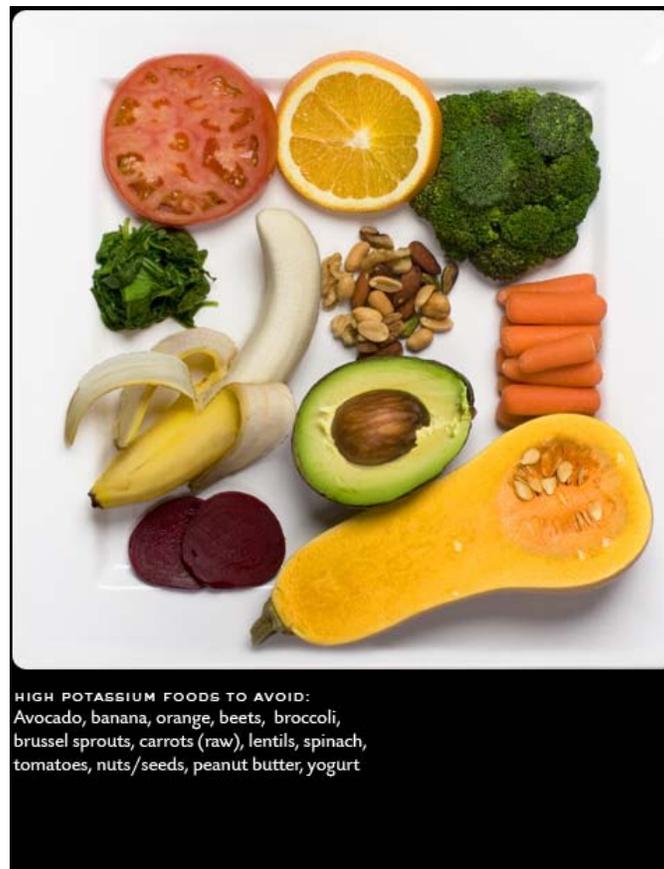
Salt Seasonings	High Salt Sauces	Salted Snacks	Cured Foods	Processed Foods
Table, Kosher and Sea Salt	Barbecue Sauces Meat Marinades	Crackers	All Luncheon Meats	Buttermilk, Cheeses
Seasoning Salt	Steak Sauces	Potato, Corn, and Tortilla Chips	Ham	Canned Soups and Vegetables
Garlic Salt	Soy Sauces	Cereals	Salt Pork	Tomato Products
Onion Salt	Teriyaki Sauces	Malted Milk, Chocolate Milk	Bacon	Vegetable Juices
Celery Salt	Oyster Sauces	Pretzels and Chex Mix	Sauerkraut	TV or Frozen Prepared Dinners
Lemon Pepper	Canned or Jarred Gravy	Nuts	Pickles and Pickle relish	Canned Pasta's and pasta sauces
Light Salt	Most Salad Dressings	Microwave Popcorn	Lox and Herring	Chili's and Canned Beans
Meat Tenderizer	Worcestershire Sauce	Movie Popcorn	Olives	Macaroni & Cheese
Bouillon Cubes	Flavored Vinegars	Sunflower Seeds	Canned Meats	Spaghetti
Flavor Enhancers	Taco Sauce	Corn Bread, Biscuits and Muffins	Salami and Pepperoni	Commercial Mixes or Boxed Dinners
Monosodium Glutamate (MSG)	Mustard & Ketchup Horseradish sauce	Reese's, Milky Way, Butterfinger	Sausages and Hot Dogs	Fast Food



If a nephrologist is concerned that the kidney cannot get rid of potassium they will want high potassium foods to be avoided. High potassium blood levels, called hyperkalemia, can cause serious problems for the heart if not controlled. If a low potassium diet is recommended by a nephrologist, it is very important to watch out for high potassium foods. Generally the daily intake of potassium should be less than 2 grams or 2000 mg.

At A Glance: High Potassium Foods

Fruits	Vegetables	Other Foods
Citrus fruits, oranges, grapefruit orange and grapefruit juices	Dried peas and beans: black, refried, pinto, baked, legumes, and lentils	Chocolate, molasses
Avocado, apricots, nectarines, papaya, mangos, pomegranates and pomegranate juice	Potatoes (white and sweet), parsnips, beets, rutabaga, Kohlrabi, cooked carrots, butternut squash, hubbard squash, acorn squash, pumpkin	Milk (all types), yogurt Bran and bran products
Bananas	Artichokes, bamboo shoots, Chinese cabbage, canned mushrooms	Nuts and seeds Peanut butter, granola
All dried fruits: dates, apricots, raisins Figs, prunes, and prune juice	Cooked spinach, all greens (except Kale) cooked broccoli, brussel sprouts	Salt substitutes, salt free broth, Nutritional supplements
Melons: honeydew, cantaloupe	Tomatoes, tomato based products, and all vegetable juices	Chewing tobacco, snuff



It is also important to control the phosphorus in the diet of a person with CKD. With CKD the kidney is not able to get rid of the body's excess phosphorus so controlling ones food intake is important. Too much phosphorus in a CKD diet can lead to weak bones and high calcium levels. Over time high calcium levels will clog blood vessels and arteries, heart, lungs and eyes with chalk like deposits. These deposits will cause the body harm. It's best to limit phosphorus to 800-1200 milligrams per day.



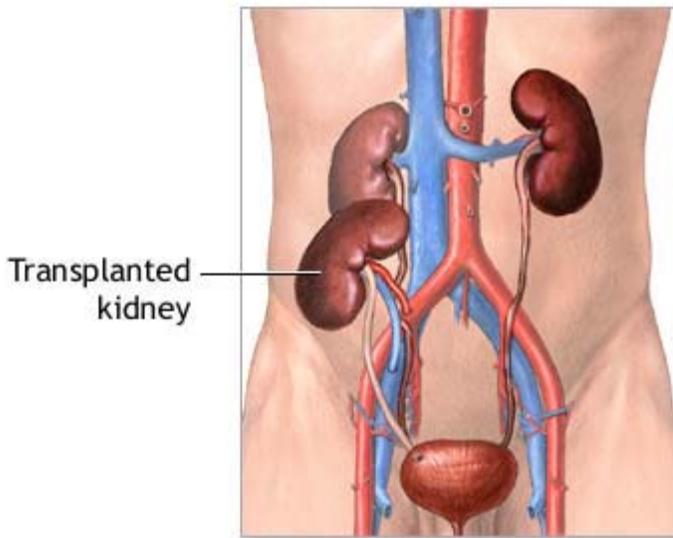
At A Glance: High Phosphorus Foods

Beverages	Dairy Products	Meats	Vegetables	Other Foods
Dark colas, ales and canned punch	Cheese and cottage cheese	Beef liver	Baked beans Pork n' beans	Bran cereal
Chocolate drinks	Yogurt	Carp, sardines	Black beans	Caramels
Drinks with milk	Milk and cream	Organ meats	Chick peas, garbanzo beans, kidney beans	Whole grain products Pancake and biscuit mix
Canned iced teas	Cream soups	Chicken liver	pinto or refried beans	Wheat germ
beer	Pudding and custards	Cray fish	Lentils, split peas soy beans	Seeds and nuts Peanut butter
cocoa	Ice cream	oysters, fish roe	Lima beans	Brewer's yeast

The diet of a person with CKD can be a very hard to follow. There are many foods that will need to be cut back or given up completely. Diet restrictions are not set to deprive someone, but to help kidneys work better. There are a lot of alternatives to favorite foods that are kidney friendly. The renal dietician is available to help give the tools to master a CKD diet. He/she will have a variety of recipes and tricks to enjoy food. Your nephrologist, nurse and dietician want you to make good lifestyle choices so that your child will grow and stay healthy.

Therapies for CKD

You've been reading about what causes chronic kidney disease, how to live with it, and how to manage the symptoms, but once kidneys stop working there isn't a way to get damaged kidneys to start working again. Kidney foundations and medical researchers are trying to find methods to cure CKD, but these cures still being developed. There are, however, therapies available to help despite having damaged kidneys. Your nephrologist will discuss with you when the right time will be to start kidney replacement therapy and which type will work best for you or your child.



Kidney Transplant

There are two different types of kidney replacement therapy. The first alternative is kidney transplant. This is not a cure for CKD. Kidney transplant is not an option for everyone. Certain medical conditions can make transplant dangerous or not likely to succeed. If a nephrologist thinks that transplant is a good option, they will refer a patient to be evaluated by a kidney transplant surgeon. Kidney transplant involves taking one healthy kidney from a donor and putting it inside the body. This "new" kidney will take over the job of the damaged ones. Once recovery from surgery is complete medication will need to be taken on

a twice daily basis to help prevent the body from recognizing there is a foreign kidney in the body. This type of medication, called immunosuppression, is taken for a lifetime. If not taken every day, the body will recognize that the new kidney doesn't belong and the body will begin to attack it. If the new kidney is rejected by the body, a treatment called dialysis is started until a new kidney can be transplanted.

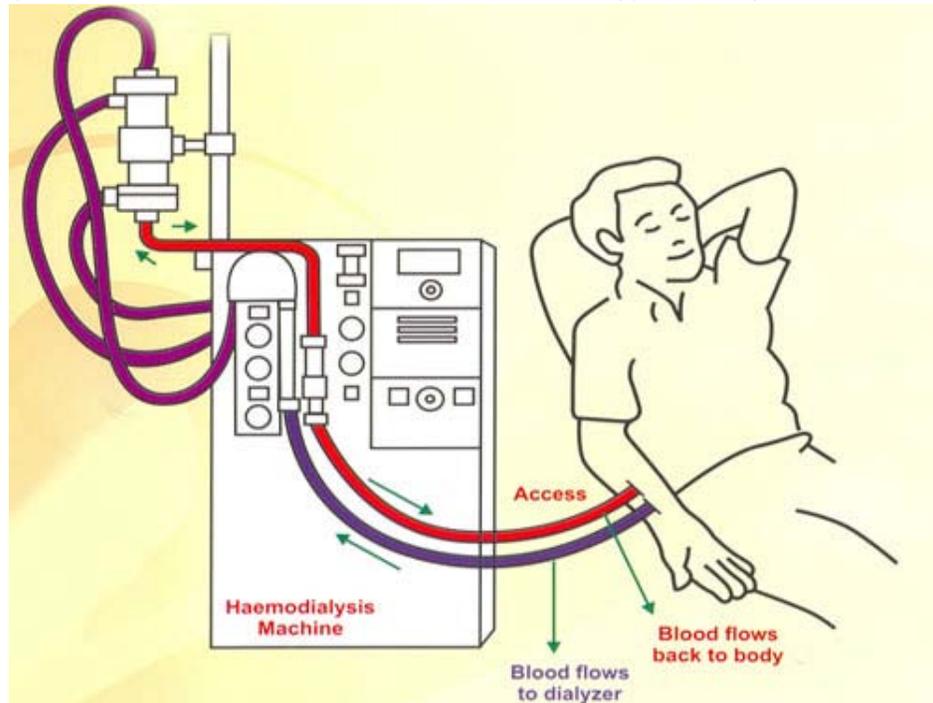
ADAM.

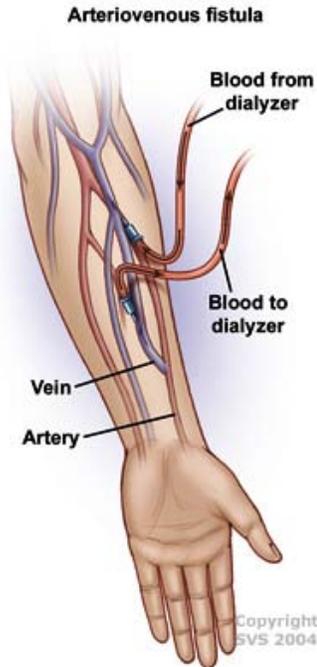
Dialysis

The second alternative therapy for CKD is dialysis. Dialysis is process by which a machine will take over the job of damaged kidneys. Dialysis is started when kidneys lose about 85-90% of their function. Dialysis is not a cure for CKD. There are two different types of dialysis:

hemodialysis
and peritoneal
dialysis.

Hemodialysis (HD) is done at a hospital or special outpatient center. Hemodialysis is process by which a machine called a dialyzer will filter blood, clean it, remove waste products, and return it to the body.



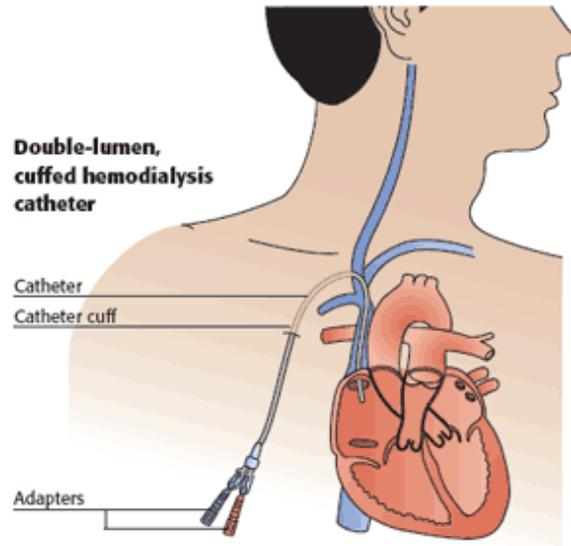


To get the blood into the machine an entrance in the body will need to be made to get the blood from the veins.

The blood is removed through a catheter placed in the chest or by a fistula accessed by a needle. A fistula is created surgically by attaching a vein and artery together to make a bigger vein under the skin. The fistula will make it easier to access the blood with a needle. You cannot see the fistula under the skin but, you can feel it. If a fistula isn't a good option a plastic tube called a hemodialysis catheter is placed. The catheter is inserted into a vein in the neck to get to access to the blood.

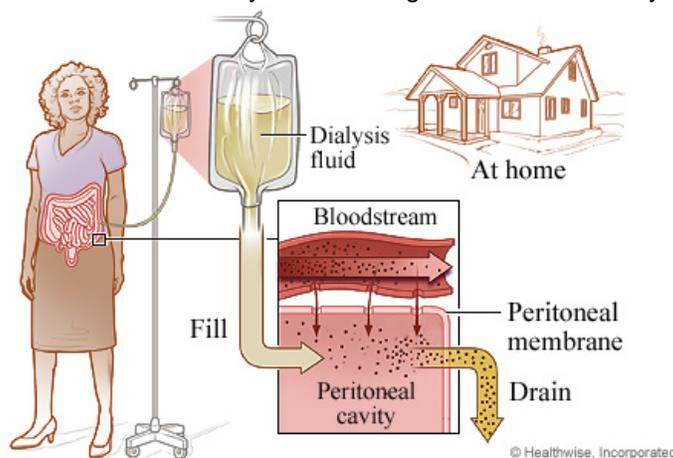
The catheter exits the body through the chest. Catheters need to be protected from

infection or damage since they can be seen outside of the body. Both the catheter and fistula placements are minor surgical procedures. HD is done at least three times a week, for at least 2-4 hours.



Peritoneal dialysis (PD) is a process where blood is cleaned inside of the body. Fluid, called dialysate, is put into the body through a catheter. The plastic catheter is placed in the abdomen and it is seen outside of the body. The catheter placement is a minor surgical procedure. The dialysate fluid flows through the catheter into the abdomen where it sits in the abdominal cavity. The blood vessels and arteries in the abdomen use the dialysate to get rid of the fluid and waste products that the kidneys can no longer remove. The dialysate will be emptied through the

catheter and will take the waste and fluid with it. Families are trained by hospital staff to do PD at home. PD is done daily, overnight.



Patients who need dialysis are still able to go to school, work and live normal lives. Adjustments to life on dialysis will need to be made, but life should be as normal as possible. How long a patient is on dialysis before transplant is different for everyone.

Chronic Kidney Disease Glossary of Terms

These terms are used in chronic kidney disease and may be or may not be related to you or your child's condition.

A

acute renal (REE-nul) failure: Sudden and temporary loss of **kidney** function. (See also **chronic kidney disease**.)

anemia (uh-NEE-mee-uh): The condition of having too few red blood cells. Healthy red blood cells carry oxygen throughout the body. If the blood is low on red blood cells, the body does not get enough oxygen. People with anemia may be tired and pale and may feel their heartbeat change. Anemia is common in people with chronic kidney disease or on dialysis

anuria (uh-NYOOR-ee-uh): A condition in which a person stops making **urine**.

arterial (ar-TEER-ee-oh-VEE-nus) (AV) fistula (FIST-yoo-la): Surgical connection of an **artery** directly to a **vein**, usually in the forearm, created in patients who will need **hemodialysis** (see **dialysis**). The AV fistula causes the vein to grow thicker, allowing the repeated needle insertions required for hemodialysis.

artery (AR-ter-ee): A blood vessel that carries blood away from the heart to body. (See also **vein**.)

autoimmune (aw-toh-ih-MYOON) disease: A disease that occurs when the body's immune system mistakenly attacks the body itself.

B

Biopsy (BY-op-see): A procedure in which a tiny piece of a body part, such as the **kidney** or **bladder**, is removed for examination under a microscope.

bladder: The balloon-shaped organ inside the pelvis that holds **urine**.

blood urea (yoo-REE-uh) nitrogen (NY-truh-jen) (BUN): A waste product in the blood that comes from the breakdown of food protein. The **kidneys** filter blood to remove **urea**. As kidney function decreases, the BUN level increases.

C

calcitriol: Healthy kidneys produce calcitriol from vitamin D that is from sunlight and food. Calcitriol helps the body regulate dietary calcium and phosphorus back into blood and bones.

catheter: A tube inserted through the skin into a blood vessel or cavity to draw out body fluid or infuse fluid. In **peritoneal dialysis** (see **dialysis**), a catheter is used to infuse **dialysate** solution into the abdominal cavity and drain it out again.

chronic kidney disease: Slow and progressive loss of **kidney** function over several years, often resulting in permanent kidney failure. People with permanent kidney failure need **dialysis** or transplantation (see **transplant**) to replace the work of the kidneys.

creatinine (kree-AT-ih-nin): A waste product from meat protein in the diet and from the muscles of the body. Creatinine is removed from blood by the **kidneys**; as kidney disease progresses, the level of creatinine in the blood increases.

D

dialysis (dy-AL-ih-sis): The process of cleaning wastes from the blood artificially. This job is normally done by the kidneys. If the kidneys fail, the blood must be cleaned artificially with special equipment. The two types of dialysis are hemodialysis and peritoneal dialysis.

- **Hemodialysis (Hee-moh-dy-AL-ih-sis):** The use of a machine to clean wastes from the blood after the **kidneys** have failed. The blood travels through tubes to a dialyzer, which removes wastes and extra fluid. The cleaned blood then flows through another set of tubes back into the body.
- **Peritoneal (PEH-rih-tuh-NEE-ul) dialysis:** Cleaning the blood by using the lining of the abdominal cavity as a filter. A cleansing liquid, called **dialysate** is drained from a bag into the abdomen. Fluids and wastes flow through the lining of the cavity and remain “trapped” in the dialysate. The dialysate solution is then drained from the abdomen, removing the extra fluids and wastes from the body.

dialysate (dy-AL-a-sate): A cleansing liquid used in the two types of **dialysis- hemodialysis** and **peritoneal dialysis**. Dialysate, or dialysis solution, contains dextrose (a sugar) and other chemicals similar to those in the body. Dextrose draws wastes and extra fluid from the body into the dialysate.

dialyzer (DY-uh-LY-zur): A part of the **hemodialysis** machine (see **dialysis**). The dialyzer has two sections separated by a membrane. One section holds the **dialysate** and the other holds the patient’s blood.

donor: A person who offers blood, tissue, or an organ for transplantation. (See **transplant**.) In kidney transplantation, the donor may be someone who has just died or someone who is alive, usually a relative.

E

edema (eh-DEE-muh): Swelling caused by too much fluid in the body.

electrolytes (ee-LEK-troh-lites): Chemicals in the body fluids that result from the breakdown of salts, including **sodium**, **potassium**, magnesium and chloride. The kidneys control the amount of electrolytes in the body. When the **kidneys** fail, electrolytes get out of balance, causing potentially serious health problems. Medication, a strict diet and dialysis can correct this problem.

end-stage renal (REE-nul) disease (ESRD): Total and permanent **kidney failure**. When the **kidneys** fail, the body retains fluid and harmful wastes build up. A person with ESRD needs treatment to replace the work of the failed kidneys.

erythropoietin (eh-RITH-roh-POY-uh-tin): A **hormone** made by the kidneys to help form red blood cells. Lack of the hormone may lead to **anemia**.

F

fistula (FIST-yoo-lah): See **arteriovenous fistula**.

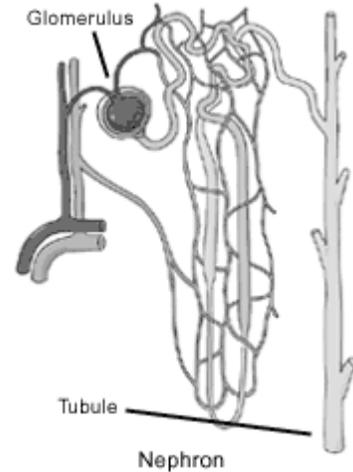
G

glomeruli (gloh-MEHR-yoo-lie): Plural of **glomerulus**.

glomerulonephritis (gloh-MEHR-yoo-loh-nef-RY-tis): Inflammation of the **glomeruli**. Most often, it is caused by an autoimmune disease, but it can also result from infection.

glomerulosclerosis (gloh-MEHR-yoo-loh-skleh-ROH-sis): Scarring of the **glomeruli**. It may result from **diabetes mellitus** (diabetic glomerulosclerosis) or from deposits in parts of the glomeruli (focal segmental glomerulosclerosis). The most common signs of glomerulosclerosis are **proteinuria** and **kidney failure**.

glomerulus (gloh-MEHR-yoo-lus): A tiny set of looping blood vessels in the **nephron** where blood is filtered in the kidney.



H

hematocrit (hee-MAT-uh-krit): A measure that tells what portion of a blood sample consists of red blood cells. Low hematocrit suggests **anemia** or massive blood loss.

hematuria (HEE-muh-TOO-ree-uh): A condition in which **urine** contains blood or red blood cells.

hemodialysis: See **dialysis**.

hormone: A natural chemical produced in one part of the body and released into the blood to trigger or regulate particular functions of the body. The kidney releases three hormones: **erythropoietin**, **renin**, and an active form of vitamin D (**calcitriol**) that helps regulate calcium for bones.

hypertension (HY-per-TEN-shun): High blood pressure, which can be caused either by too much fluid in the blood vessels or by narrowing of the blood vessels.

I

immune (ih-MYOON) system: The body's system for protection itself from viruses and bacteria or any "foreign" substance.

immunosuppressant (ih-MYOON-oh-suh-PRESS-unt): A drug given to suppress the natural responses of the body's immune system. Immunosuppressants are given to transplant patients to prevent organ rejection and to patients with autoimmune diseases.

interstitial (IN-ter-STISH-ul) nephritis (nef-RY-tis): Inflammation of the kidney cells that are not part of the fluid-collecting units, a condition that can lead to **acute renal failure**.

K

kidney: One of two bean-shaped organs that filter wastes from the blood. The kidneys are located near the middle of the back. They create **urine**, which is delivered to the **bladder** through tubes called **ureters**.

kidney failure: Loss of **kidney** function (See also **end-stage renal disease**, **acute renal failure**, and **chronic kidney disease**).

M

membrane: A thin sheet or layer of tissue that lines a cavity or separates two parts of the body. A membrane can act as a filter, allowing some particles to pass from one part of the body to another while keeping others where they are. The artificial membrane in a **dialyzer** filters waste products from the blood.

membranoproliferative (MEM-bray-nop-pro-LIF-er-uh-tiv) glomerulonephritis (gloh-MEHR-yoo-loh-nef-RY-tis): A disease that occurs primarily in children and young adults. Over time, inflammation leads to scarring in the **glomeruli**, causing **proteinuria**, **hematuria**, and sometimes **chronic kidney disease** or **end-stage renal disease**.

N

nephrectomy (nef-REK-tuh-mee): Surgical removal of a **kidney**.

nephrologist (nef-RAHL-oh-jist): A doctor who treat patients with **kidney** problems or **hypertension**.

nephron (NEF-rah-n): A tiny part of the **kidneys**. Each kidney is made up of about 1 million nephrons, which are the working units of the kidneys, removing wastes and extra fluids from the blood.

nephrotic (nef-RAH-tik) syndrome: A collection of symptoms that indicate **kidney** damage. Symptoms include high levels of protein in the **urine**, lack of protein in the blood, and high blood cholesterol.

P

peritoneal (PEH-rih-tuh-NEE-ul) cavity: Space inside the lower abdomen but outside the internal organs.

peritoneal dialysis: See **dialysis**.

potassium (puh-TASS-ee-um): A mineral found in the body and in many foods.

proteinuria (PRO-tee-NOOR-ee-uh): A condition in which the urine contains large amounts of protein, a sign that the **kidneys** are not functioning properly.

R

renal (REE-nul): Of the kidneys. A renal disease is a disease of the **kidneys**. Renal failure means the kidneys have stopped working properly.

renal osteodystrophy (AH-stee-oh-DIS-truh-fee): Weak bones caused by poorly working kidneys. Renal osteodystrophy is a common problem for people on dialysis who have high phosphate levels or insufficient vitamin D supplementation.

renin (REE-nin): A **hormone** made by the **kidneys** that helps regulate the volume of fluid in the body and blood pressure.

S

sodium (SOH-dee-um): A mineral found in the body and in many foods.

T

transplant: Replacement of a diseased organ with a healthy one. A **kidney** transplant may come from a living **donor**, usually a relative, or from someone who has just died.

U

urea (yoo-REE-uh): A waste product found in the blood and caused by the normal breakdown of protein in the liver. Urea is normally removed from the blood by the **kidneys** and the excreted in the **urine**. Urea accumulates in the body of the people with renal failure.

uremia (yoo-REE-mee-uh): The illness associated with the buildup of **urea** in the blood because the **kidneys** are not working effectively. Symptoms include nausea, vomiting, loss of appetite, weakness, and mental confusion.

ureters (YOOR-uh-turs): Tubes that carry **urine** from the **kidneys** to the **bladder**.

urethra (yoo-REE-thrah): The tube that carries **urine** from the **bladder** to the outside of the body.

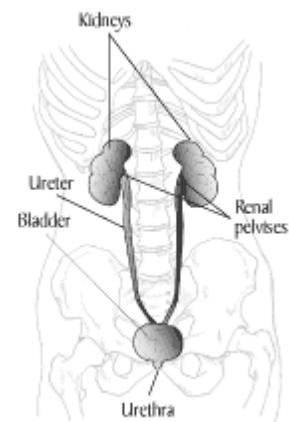
urinalysis (yoor-in-AL-ih-sis): A test of a **urine** sample that can reveal many problems of the urinary system and other body systems. The sample may be observed for color, cloudiness, and concentration; signs of drug use; chemical composition, including sugar; the presence of protein, blood cells, or germs; or other signs of disease.

urinary (YOOR-ih-NEHR-ee) tract: The system that takes wastes from the blood and carries them out of the body in the form of **urine**. The urinary tract includes the **kidneys**, **renal** pelvises, **ureters**, **bladder**, and **urethra**.

urine (YOOR-in): Liquid waste product filtered from the blood by the **kidneys**, stored in the **bladder**, and expelled from the body through the **urethra** by the act of voiding or urinating. (See also **urinate**.)

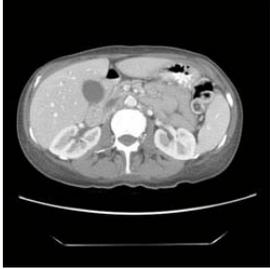
V

Vein (VANE): A blood vessel that carries blood toward the heart.



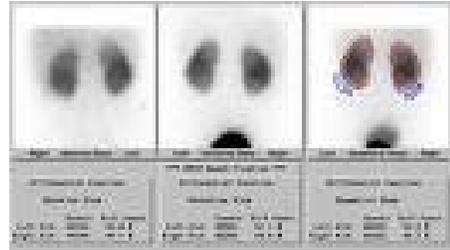
Common CKD Diagnostic Tests

CT scan (computed tomography or CAT scan): is a test that combines special x-ray equipment with computers to produce multiple pictures of the inside of the body. These pictures of organs, soft tissues and blood vessels show more detail than regular x-ray exam.



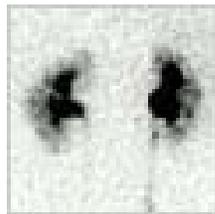
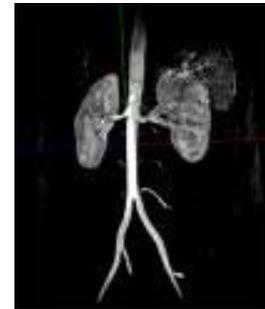
DMSA (technetium dimercaptosuccinic acid) scan: is a test used to find problems in the kidneys. Special pictures are taken after a medicine is injected into a vein. The medicine is called a radiopharmaceutical (a tiny amount of a radioactive liquid).

The pictures show the medicine in the kidneys. The scan will evaluate the size, shape and position of the kidneys. It will tell your nephrologist whether or not the kidneys are scarred from past infections.



Kidney Biopsy: is a test done by taking a piece of kidney tissue and examining it under a microscope. The tissue is obtained by inserting a guided needle into the kidney. This is done in the hospital and while the patient is asleep. The kidney tissue is studied to see if there is scarring or changes in the kidney tissue. These changes may tell the nephrologist how the kidney was damaged or what type of kidney disease the patient has.

MRI (magnetic resonance imaging) scan: is a test that uses a powerful magnet and radiofrequencies to produce pictures of the inside of the body. The pictures are produce in 2 or 3 dimensions (meaning you can see the image from all sides).



Mag 3 scan with Lasix®: is a test done to see how each kidney works. An intravenous catheter (IV) is placed into a vein for this test. Pictures are taken after a radiopharmaceutical (radioactive liquid) fluid is in the IV. A urinary catheter is also inserted to keep the bladder empty of urine. A medication called Lasix® may be used to allow the kidneys to produce more urine. This test will see how much function the left and right kidneys have while they make urine.

Ultrasound: uses sound waves to produce images of the organs and create an image in a computer. The ultrasound is used to view the size, shape and texture of the kidney and bladder. It is helpful to rule out any structural problems with the kidneys.



VCUG (Voiding Cysto-Urethrogram): voiding is another word for urinating. A VCUG is a test that looks at the bladder's size, shape and how much urine it holds as well as the urethra. The urethra is a tube that connects the bladder with the outside of the body. This test also shows if reflux is present. Reflux means that urine goes upward back to the kidneys. This exam may be ordered if a child has many urinary tract infections (UTI's).

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