

Complete Guide for Kidney Patients

Save Your Kidneys

Comprehensive Information about
Prevention and Treatment of Kidney Diseases

Edgar V. Lerma

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Do you know?

- There is an alarming rise in the number of patients with kidney failure.
- The treatment cost of end stage kidney disease is more than that of heart surgery.
- Knowing and understanding more about kidney diseases will enable you to better cope with this common ailment and can also avert untoward complications.

Highlights of the Book

- Easy to read – aimed to provide up-to-date practical information about kidney diseases.
- Simple guidelines which everyone must know to keep the kidneys healthy.
- Simple tips on how to recognize warning signs of early kidney disease, thereby allowing for prompt diagnosis and treatment.
- Practical and detailed treatment advice for patients diagnosed to have chronic kidney disease (CKD), which could potentially delay the need for initiation of dialysis or kidney transplantation.
- Detailed explanation of dietary selections and restrictions for patients with various stages of kidney disease.

Read, Heed and Save Your Kidneys

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Prevention and Treatment of Kidney Diseases**

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**This book is dedicated to all patients with
kidney disease and their families.**

2. **Carbohydrate:** To ensure that the body gets adequate calories, the CKD patient can take sugar or glucose containing food along with cereals provided he/she is not diabetic.
3. **Protein:** Lean meat, milk, cereals, legumes, eggs and chicken are the main sources of protein. CKD patients who are not on dialysis are advised to limit dietary protein to < 0.8 grams/kg body weight/day. Once dialysis is started, dietary intake can be increased to 1-1.2 grams/kg body weight/day.
Patients undergoing peritoneal dialysis may need dietary proteins as high as 1.5 grams/kg body weight per day. While animal proteins contain all essential amino acids (hence are called complete proteins or proteins with high biologic value) and would be ideal, they should be limited especially in patients not yet on dialysis because they may accelerate the progression of CKD.
4. **Fat:** Fats may be taken in as an energy source since they are a good source of calories. Monounsaturated and polyunsaturated fats in the form of olive oil, safflower oil, canola oil or soybean oil may be taken in limited quantities. Avoid saturated fats such as those found in animal lards.
5. **Salt:** Most patients are advised to take a low salt diet. It is good to observe a “no added salt” diet. Look at food labels and go for low sodium foods but make sure that salt substitutes containing high amounts of potassium are also avoided. Check food labels for other foods containing sodium such as sodium bicarbonate (baking powder) and avoid them.
6. **Cereals:** Rice or rice products like flattened rice can be taken. To avoid monotony of taste one can rotate intake of various cereals like wheat, rice, sago, semolina, all purpose flour, and cornflakes. Small quantities of corn and barley can be taken.

7. **Vegetables:** Vegetables with low potassium can be liberally taken. But vegetables with high potassium must be processed to remove potassium before consumption. To improve taste, lemon juice can be added.
8. **Fruits:** Fruits with low potassium content like apple, papaya and berry can be taken but only once a day. On the day of dialysis, patients can take any one fruit. Fruit juice and coconut water must be avoided.
9. **Milk and milk products:** Milk and milk products such as milk, yogurt and cheese contain large amounts of phosphorus and need to be limited. Other dairy foods that have lower amounts of phosphorus include butter, cream cheese, ricotta cheese, sherbets and nondairy whipped toppings may be taken instead.
10. **Cold drinks:** Avoid dark colored sodas as they have a high phosphorus content. Do not take fruit juice or coconut water because of the potentially high potassium content.
11. **Dry fruits:** Dry fruits, groundnut, sesame seeds, fresh or dry coconut must be avoided.

Glossary

Glossary

Acute kidney failure (injury): A condition in which there is sudden or rapid loss of kidney functions. This type of kidney damage is temporary and usually reversible.

Anemia: It is a medical condition in which hemoglobin is reduced in blood. Anemia leads to weakness, fatigue and shortness of breath on exertion. Anemia is common in CKD and occurs due to decreased erythropoietin production by kidney.

Automated peritoneal dialysis (APD): See CCPD.

Arteriovenous fistula (AV Fistula): It means creating a connection between artery and vein surgically, usually in the forearm. In an AV fistula a large amount of blood with high pressure enters into the vein causing dilatation of the vein. The enlarged dilated veins allow easy repeated needle insertion required for hemodialysis. AV fistula is the most common and the best method of vascular access for long term hemodialysis.

Artificial kidney: See dialyzer.

Benign prostatic hypertrophy (BPH): It is common for the prostate gland to become enlarged as a man ages. BPH is a non-cancerous prostatic enlargement in elderly males which compresses the urethra, blocks urine stream and causes problems in urination.

Blood pressure: It is the force exerted by circulating blood on the walls of blood vessels as the heart pumps out blood. Blood pressure is one of the principal vital signs and its measurement consists of two numbers. The first number indicates systolic blood pressure which measures the maximum pressure exerted when heart contracts. The second number indicates diastolic pressure, a measurement taken between beats, when the heart is at rest.

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Brain death: Brain death: It is a severe and permanent damage to brain that does not respond with any medical or surgical treatment. In brain death, the body's respiration and blood circulation are artificially maintained.

Cadaveric kidney transplantation: See deceased kidney transplantation.

Calcium: The most abundant mineral in the body, essential for the development and maintenance of strong bones and teeth. Milk and milk products like yogurt and cheese are rich natural sources of calcium.

Catheter for hemodialysis: It is a long, flexible hollow tube with two lumens. Blood is withdrawn from one lumen, enters the dialysis circuit for purification, and is returned to the body via the other lumen. Insertion of double lumen catheter is the most common and effective method for emergency and temporary hemodialysis.

Continuous ambulatory peritoneal dialysis (CAPD): CAPD is a form of dialysis that can be carried out by a person at home without the use of a machine. In this type of dialysis, fluid is exchanged at regular intervals throughout the day, i.e. 24-hours a day, seven days a week.

Continuous cycling peritoneal dialysis (CCPD): CCPD or Automated peritoneal dialysis (APD) is a form of continuous peritoneal dialysis carried out at home every day with an automated cyclor machine. In CCPD, a machine performs fluid exchanges while the patient is sleeping at night. In this process the machine automatically fills and drains the dialysis solution from the abdomen.

Creatinine and urea: These are breakdown or waste products of protein metabolism. These substances are removed by kidneys. The usual level of serum creatinine is 0.8 to 1.4 mg% and that of urea is 2 to 4 mg%. In kidney failure the level of urea and creatinine in blood rises.

Chronic kidney disease (CKD): Gradual progressive and irreversible loss of kidney function over several months to years is called chronic kidney disease. In this non- curable disease, kidney function reduces slowly and continuously. After a long period it reduces to a stage where the kidney stops working almost completely. This advanced and life

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threatening stage of the disease is called End Stage Kidney Disease ESKD.

Cystoscopy: A diagnostic procedure in which the doctor looks inside the bladder and the urethra using a thin, lighted instrument called a cystoscope.

Deceased (cadaveric) kidney transplantation: It is a surgical procedure in which a healthy kidney donated by a person with brain death is transplanted in a patient with chronic kidney disease.

Diabetic kidney disease (nephropathy): Long-standing diabetes causes damage to small blood vessels of the kidney. This damage initially causes loss of protein in urine. Subsequently it causes hypertension, swelling and then gradual and progressive damage to the kidney. Finally, progressive deterioration leads to severe kidney failure (End stage kidney disease). This diabetes induced kidney problem is known as diabetic kidney disease. Diabetic kidney disease is the most common cause of chronic kidney disease, accounting for 40-45 percent of new cases of CKD.

Dialysis: It is an artificial process by which waste products and unwanted water is removed from the body in patients with kidney failure.

Dialyzer: An artificial kidney that filters blood and removes wastes and extra water from the body in the process of hemodialysis.

Diuretics: Drugs that increase the production of urine and increases excretion of water in the form of urine which helps to lose water from body. Diuretics are also called “water pills.”

Dry weight: It is the weight of a person after all excess fluid is removed by dialysis.

Dwell time: During peritoneal dialysis, the period for which PD fluid remains in the abdomen is called the dwell time. During dwell time the process of purification takes place.

eGFR: The eGFR (estimated Glomerular Filtration Rate) is a number which is calculated from blood creatinine level and other information. eGFR measures how well kidneys are working and its normal value is 90 or more. The eGFR test is useful for the diagnosis, grading of stages and monitoring the progression of CKD.

Electrolytes: There are many minerals like sodium, potassium, calcium in the blood stream that regulate important function of the body. These chemicals are called electrolytes. As the kidney keeps the electrolyte concentrations constant in blood, in patients with kidney diseases, blood is tested to check electrolyte levels.

Endstage kidney disease (ESKD): Advanced stage of chronic kidney disease (Stage 5 CKD) is known as endstage kidney disease (ESKD) or end stage renal disease (ESRD). At this stage of CKD there is complete or almost complete failure of the kidneys. ESKD patients need treatment, such as dialysis or transplantation, to lead a fairly normal life.

Erythropoietin (EPO): It is a hormone produced by the kidneys that promotes the formation of red blood cells by the bone marrow. If the kidneys are damaged, they are not able to produce enough erythropoietin resulting in decrease in the formation of red blood cells which leads to anemia. Erythropoietin is available as an injectable medication for the treatment of anemia due to kidney failure.

Exchange: It means one complete cycle of peritoneal dialysis, consisting of three stages. The first stage is inflow of dialysis fluid in the abdomen. In the second stage, the fluid remains in the abdomen for several hours allowing excess fluid and toxins to move from the blood to the dialysis fluid (also called dwell). The third stage is outflow of the dialysis fluid.

Extracorporeal shock wave lithotripsy (ESWL): It is a modality in which highly concentrated shock waves produced by a lithotripter machine break up urinary stones. The stones break down into small particles and are easily passed through the urinary tract in urine. ESWL is an effective and widely used treatment modality for kidney stones.

Fistula: See arteriovenous fistula.

Graft: A type of access for long term hemodialysis. Graft is a short piece of synthetic soft tube which joins a vein and an artery in the arm. Needles are inserted in this graft during hemodialysis treatment.

Hemodialysis: Most popular modality to treat kidney failure. In hemodialysis blood is purified with the help of dialysis machine and an artificial kidney (dialyzer).

Hemoglobin: It is a protein molecule in red blood cells that carries oxygen from the lungs to the body tissues and returns carbon dioxide from the tissues to the lungs. Hemoglobin is measured by blood test and its reduced value is referred as anemia.

Hyperkalemia: Normal serum potassium levels are between 3.5 and 5.0 mEq/L. Hyperkalemia is a condition characterized by elevated levels of potassium in the blood. Hyperkalemia is common in kidney failure, can be life threatening, and requires urgent medical treatment.

Hypertension: It is the term used to describe high blood pressure.

Immunosuppressant Drug: Medications that suppress or decrease the body's immune system and prevent the body from rejecting a transplanted organ.

Intravenous urogram (IVU): It is an investigation where a series of x-rays of the urinary system is taken after injecting an intravenous iodine containing dye. This test gives information about function of the kidney and structure of the urinary tract.

Kidney biopsy: A procedure to get a small piece of kidney tissue with a needle so that it can be examined under a microscope for the diagnosis of the disease.

Kidney failure: Condition in which deterioration in kidney function leads to inadequate filtration of toxins and waste products from the blood. It is characterized by an increase in urea and creatinine levels in blood.

Microalbuminuria: Refers to the appearance of small but abnormal amounts of albumin in urine. Its presence indicates early onset of diabetic kidney disease.

Micturating cystourethrogram: See voiding cystourethrogram.

Nephron: The functional unit of the kidney responsible for the actual purification and filtration of the blood. Each kidney contains about one million nephrons.

Nephrologist: A physician specialized in kidney diseases.

Nephrotic syndrome: Kidney problem that is seen more frequently in

children characterized by loss of protein in urine (more than 3.5 grams per day), low blood protein levels, high cholesterol levels, and swelling.

Paired kidney transplantation: Many patients with endstage kidney disease have healthy and willing potential kidney donors with an incompatible blood type or tissue cross match. Paired kidney donation is the strategy that allows the exchange of living donor kidneys between two incompatible donor/recipient pairs to create two compatible pairs.

Peritoneal dialysis: It is an effective treatment modality for kidney failure. In this process of purification, dialysis fluid is introduced into the abdominal cavity through a special catheter. This fluid removes waste products and extra water from the blood. Fluid is removed from the abdomen after a variable period of time, and discarded.

Peritonitis: It is an infection inside the abdominal cavity. Peritonitis is a common complication of peritoneal dialysis and can be life threatening, if not treated.

Phosphorus: Phosphorus is the second most-abundant mineral found in the body, next only to calcium. It works with calcium to build strong bones and teeth. Meats, nuts, milk, eggs, cereals are phosphorus rich foods.

Polycystic kidney disease (PKD): PKD is the most common genetic disorder of the kidney, characterized by the growth of numerous cysts (fluid sacs) in the kidneys. It is among the leading causes of chronic kidney disease.

Potassium: It is a very important mineral in the body needed for the proper function of nerves, heart and muscles. Fresh fruit, fruit juices, coconut water and dry fruits are rich sources of potassium.

Pre-emptive kidney transplantation: Kidney transplantation is usually carried out after a variable period of dialysis therapy. A kidney transplant done before the initiation of maintenance dialysis is a pre-emptive kidney transplant.

Proteins: They are one of the three main classes of food that build, repair and maintain body tissues. Pulses, milk, eggs and animal foods are rich sources of protein.

Proteinuria: Presence of abnormally high levels of protein in urine.

Rejection: The process in which the body recognizes that a transplanted organ is not its own and tries to destroy it.

Semipermeable membrane: A membrane that selectively allows certain dissolved substances and fluid to pass through, while holding back the others. Membrane is a thin natural tissue or artificial material.

Sodium: A mineral in the body that regulates blood pressure and blood volume. The most common form of sodium in food is sodium chloride, which is table salt.

Trans-urethral Resection of the Prostate (TURP): It is the standard treatment for benign prostatic hyperplasia (BPH) performed by urologists. In this minimally-invasive surgical treatment, an instrument called a cystoscope is passed through the urethra and the prostate gland blocking the urine flow is removed.

Ultrasound: It is a painless diagnostic test that uses high frequency sound waves to create an image of the organs or structures inside the body. Ultrasound is a simple, useful and safe test that provides valuable information such as the size of kidney, obstruction to urine flow, and the presence of cyst, stone and tumors.

Urologist: A surgeon specialized in kidney diseases.

Vesicoureteral reflux (VUR): It is a condition with an abnormal backward flow (reflux) of urine from the bladder toward the ureters and possibly up to the kidneys. This is an anatomic and functional disorder that can happen either on one or both sides. VUR is the major cause of urinary tract infection, high blood pressure and kidney failure in children.

Voiding cystourethrogram: A procedure used to outline the anatomy of the lower urinary tract (bladder and urethra) by catheterizing a patient and introducing solution (dye) which can be seen on X-ray films. The patient is asked to void urine and X-rays are taken

Abbreviations

ACE	: Angiotensin Converting Enzyme
ADPKD	: Autosomal Dominant Polycystic Kidney Disease
AGN	: Acute Glomerulonephritis
AKI	: Acute Kidney Injury
APD	: Automated Peritoneal Dialysis
ARB	: Angiotensin Receptor Blockers
ARF	: Acute Renal Failure
AV Fistula	: Arterio Venous Fistula
BP	: Blood Pressure
BPH	: Benign Prostatic Hypertrophy/Hyperplasia
BUN	: Blood Urea Nitrogen
CAPD	: Continuous Ambulatory Peritoneal Dialysis
CCPD	: Continuous Cycling Peritoneal Dialysis
CKD	: Chronic Kidney Disease
CRF	: Chronic Renal Failure
DKD	: Diabetic Kidney Disease
DM	: Diabetes Mellitus
DMSA	: Dimercaptosuccinic Acid
eGFR	: Estimated Glomerular Filtration Rate
EPO	: Erythropoietin
ESKD	: End Stage Kidney Disease
ESRD	: End Stage Renal Disease
ESWL	: Extracorporeal Shock Wave Lithotripsy
GFR	: Glomerular Filtration Rate
HD	: Hemodialysis

IDDM	: Insulin Dependent Diabetes Mellitus
IJV	: Internal Jugular Vein
IPD	: Intermittent Peritoneal Dialysis
IVU/IVP	: Intravenous Urography/Pyelography
MA	: Microalbuminuria
MCU	: Micturating Cysto Urethrogram
MRI	: Magnetic Resonance Imaging
NIDDM	: Non-Insulin Dependent Diabetes
NSAID	: Non-Steroidal Anti-Inflammatory Drug
PCNL	: Percutaneous Nephrolithomy
PD	: Peritoneal Dialysis
PKD	: Polycystic Kidney Disease
PSA	: Prostate Specific Antigen
PUV	: Posterior Urethral Valves
RBC	: Red Blood Cells
RRT	: Renal Replacement Therapy
TB	: Tuberculosis
TIBC	: Total Iron Binding Capacity
TURP	: Trans Urethral Resection of Prostrate
UTI	: Urinary Tract Infection
VCUG	: Voiding Cysto Urethrogram
VUR	: Vesicoureteral Reflux
WBC	: White Blood Cells

Common Blood Tests for Kidney Patients

Commonly used laboratory blood tests for kidney patients and their reference ranges are summarized below.

Test	Conventional units	Conversion factor	SI units
Blood Tests for Kidney Function			
Blood urea nitrogen	8 - 20 mg/dl	0.36	2.9 - 7.1 mmol/L
Creatinine	Male	0.7 - 1.3 mg/dl	68 - 118 mcmd/L
	Female	0.6 - 1.2 mg/dl	50 - 100 mcmd/L
eGFR	90 - 120 ml/min	--	--
Blood Tests for Anemia			
Hemoglobin	Male	13.5 - 17.0 g/dl	136 - 175 g/L
	Female	12.0 - 15.5 g/dl	120 - 155 g/L
Hematocrit	Male	41 - 53%	0.41 - 0.53
	Female	36 - 48%	0.36 - 0.48
Iron total	50 - 175 mcg/dl	0.18	9 - 31 mcmol/L
Iron-binding capacity total	240 - 450 mcg/dl	0.18	45 - 82 mcmol/L
Transferrin	190 - 375 mg/dl	0.01	1.9 - 3.75 g/L
Transferrin saturation	20 - 50 %	--	--
Ferritin	Male	16 - 300 ng/ml	36 - 675 pmol/L
	Female	10 - 200 ng/ml	22.5 - 450 pmol/L

Test	Conventional units	Conversion factor	SI units
Blood Tests for Electrolytes and Metabolic Bone Diseases			
Sodium (Na)	135 - 145 mEq/L	1.0	135 - 145 mmol/L
Potassium (K)	3.5 - 5.0 mEq/L	1.0	3.5 - 5.0 mmol/L
Chloride (Cl)	101 - 112 mEq/L	1	101 - 112 mmol/L
Calcium ionized	4.4 - 5.2 mg/dL	0.25	1.10 - 1.30 mmol/L
Calcium total	8.5 - 10.5 mg/dl	0.25	2.2 - 2.8 mmol/L
Phosphorus inorganic	2.5 - 4.5 mg/dl	0.32	0.8 - 1.45 mmol/L
Magnesium	1.8 - 3 mg/dl	0.41	0.75 - 1.25 mmol/L
Bicarbonate	22 - 28 mEq/L	1	22 - 28 mmol/L
Uric acid	Male 2.4 - 7.4 mg/dl Female 1.4 - 5.8 mg/dl	59.48	140 - 440 mcmol/L 80 - 350 mcmol/L
PTH	11 - 54 pg/ml	0.11	1.2 - 5.7 pmol/L
Blood Tests for General Health			
Protein Total	6.0 - 8.0 g/dl	10	60 - 80 g/L
Albumin	3.4 - 4.7 g/dl	10	34 - 47 g/L
Cholesterol total	100 - 220 mg/dl	0.03	3.0 - 6.5 mmol/L
Blood sugar fasting	60 - 110 mg/dl	0.055	3.3 - 6.1 mmol/L
Blood Tests for Liver Function			
Bilirubin Total	0.1 - 1.2 mg/dl	17.1	2 - 21 mcmol/L
Direct	0.1 - 0.5 mg/dl	17.1	<8 mcmol/L
Indirect	0.1 - 0.7 mg/dl	17.1	<12 mcmol/L
Alanine transaminase (SGPT)	7 - 56 unit/L	0.02	0.14 - 1.12 mckat/L
Aspartate transaminase (SGOT)	0 - 35 units/L	0.02	0 - 0.58 mckat/L
Alkaline phosphatase	41 - 133 units/L	0.02	0.7 - 2.2 mckat/L

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