

# KIDNEY CANCER (ADULT) - RENAL CELL CARCINOMA

## What Is Cancer?

Cancer is a group of many related diseases. All forms of cancer cause cells in the body to change and grow in an abnormal way.

Normal body cells divide and grow in an orderly fashion. But cancer cells divide and grow out of control. This out-of-control growth damages normal body tissues and disrupts the ability of organs to function as they should.

During the early years of a person's life, normal cells divide more rapidly until adult size is reached. After that, normal cells of most tissues divide only to replace worn-out tissue and to repair injuries.

Cancer cells, however, continue to grow. Often the cells form *tumors* (lumps) that compress, invade, and destroy normal tissue. Unless the cancer is treated, the tumors can grow and spread. If cells break away from such a tumor, they can travel through the bloodstream or the lymph system to other areas of the body. There, they may settle and form "colony" tumors. In their new location, the cancerous cells begin growing again. The spread of a tumor to a new site is called *metastasis*.

Leukemia, a form of cancer, does not usually form a tumor. Instead, cancer cells invade the blood and blood-forming organs (spleen, lymphatic system, and bone marrow).

It is important to realize that not all tumors are cancerous. Benign tumors, which stay in one place and have limited growth, are usually not life-threatening.

Cancer is classified by the part of the body in which it develops, by its appearance under the microscope, and by the results of laboratory tests. Since cancer is not a single disease, each type of cancer behaves differently. What's more, different cancers also respond in various ways to different types of treatment. That's why people with cancer need treatment that is aimed at their specific form of the disease.

In America, one in two men and one in three women will develop cancer during their lifetime. Cancer is not necessarily fatal. Today, millions of people are cancer survivors. And the risk of developing many forms of cancer can be reduced by positive changes in a person's lifestyle. The sooner a cancer is found, and the sooner treatment begins, the better a patient's chances are of a cure.

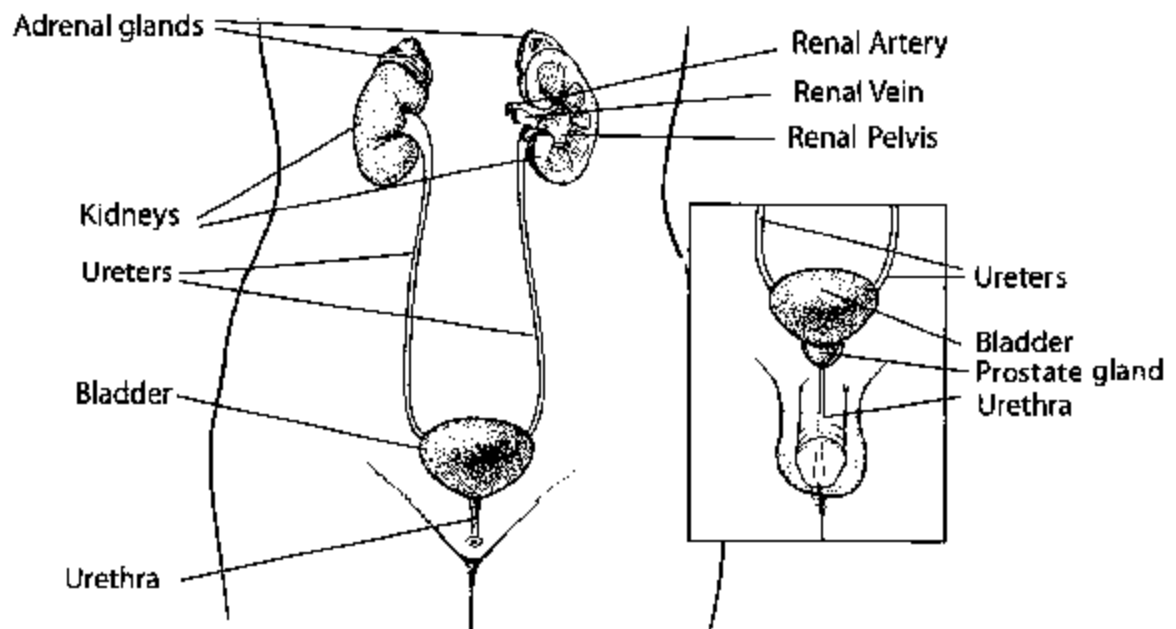
## What Is Kidney Cancer (Renal Cell Carcinoma)?

Renal cell carcinoma is the most common type of kidney cancer. *Renal* is the Latin word for kidney.

### About the Kidneys

The kidneys are two large bean-shaped organs fixed to the upper back wall of the abdominal cavity. One kidney is just to the left and the other just to the right of the backbone. Both are protected by the lower ribcage.

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The kidneys' main job is to filter the blood and rid the body of excess water, salt, and waste products. The filtered waste products are concentrated into urine. Urine leaves the kidneys through long slender tubes called *ureters* that connect to the *bladder*. Urine flows down the ureters into the bladder where it is stored until urination.

Although our kidneys are important, we actually need less than one complete kidney to do all of the important functions discussed above. Tens of thousands of people in the United States are living normal healthy lives with just one kidney. Some people may not have any working kidneys at all, and survive with the help of a medical procedure called dialysis. Dialysis uses a specially designed machine that acts like a real kidney to filter the blood.

### Renal Cell Carcinoma

Like all cancers, renal cell carcinoma begins small and grows larger over time. Although renal cell carcinoma usually grows as a single mass within the kidney, a kidney may contain more than one tumor, or tumors may be found in both kidneys at the same time. Some renal cell carcinomas are noticed only after they have become quite large, but most are found before they *metastasize* (spread) to other organs through the bloodstream or lymph vessels. Like most cancers, renal cell carcinoma is difficult to treat once it has metastasized.

There are five main *types* of renal cell carcinoma that are identified by examining the tumor under a microscope: *clear cell*, *papillary*, *chromophobe*, *collecting duct*, and "*unclassified*."

When viewed under a microscope *clear cell* renal cell carcinoma appears very pale or clear. This is the most common form of renal cell carcinoma. About 70% to 80% of people with renal cell carcinoma have this kind of cancer. *Papillary* renal cell carcinoma is the second most common type -- about 10% to 15% of people have this kind. These cancers form little finger-like projections that are called *papillae* in some if not most of the tumor. Some doctors call these cancers *chromophilic* because the cells take up certain dyes used in preparing the tissue to be viewed under the microscope, causing them to appear pink. *Chromophobe* renal carcinoma is the third most common type -- accounting for about 5% of cases. The cells of these cancers are also pale like the clear cells, but are much larger and have certain other features that can be recognized. The fourth type, *collecting duct* renal carcinoma, is very rare. Their major feature is that the cancer cells can form irregular tubes. About 5% of renal cancers are *unclassified* because their appearance doesn't fit into any of the other categories.

Another important aspect of a renal cell carcinoma is its *grade*. This refers to how closely the cancer cells' nuclei (part of a cell in which DNA is stored) look like normal kidney cells' nuclei. Renal cell cancers are usually graded on a scale of 1 through 4. Grade 1 renal cell cancers have cell nuclei that differ very little from normal kidney cell nuclei. These cancers usually grow and spread slowly, and tend to have a good prognosis. At the other extreme, grade 4 renal cell cancer nuclei look quite different from normal kidney cell nuclei and have a worse prognosis.

Although the cell type and grade are sometimes helpful in predicting prognosis, the cancer's stage is by far the best predictor of survival. The stage describes the cancer's size and how far it has spread beyond the kidney. Staging is explained in the section "How is Kidney Cancer (Renal Cell Carcinoma) Staged?"

### **Other Types of Kidney Tumors**

Renal cell carcinoma is the most common kidney cancer; it accounts for more than 90% of malignant kidney tumors. Less common types of tumors include transitional cell carcinomas, Wilms' tumors, renal sarcomas, renal cell adenomas, renal oncocytomas, and angiomyolipomas.

**Transitional cell carcinoma:** About 5% to 10% of all kidney tumors are *transitional cell carcinomas* also known as *urothelial carcinomas*. Transitional cell carcinomas begin in the *renal pelvis* (the junction of ureter and kidney). Under the microscope, they look like bladder cancer cells and they act very much like bladder cancer. Studies have shown that, like bladder cancer, these cancers, are linked to cigarette smoking and occupational exposures to certain cancer-

causing chemicals. Patients with transitional cell carcinomas can have the same signs and symptoms as patients with renal cell cancer -- blood in the urine and, sometimes, back pain.

These cancers are usually treated by surgically removing the whole kidney and the ureter, as well as that portion of the bladder where the ureter attaches. Chemotherapy and radiation therapy are often used in addition to surgery, depending on how much cancer is found. Patients with early transitional cell carcinomas have several treatment options available to them. There are different ways to surgically treat early disease. Newer surgical techniques are also being studied. Patients should consult their surgeons and be aware of their options and the benefits and risks of those options.

About 90% of transitional cell carcinomas of the kidney are curable if they are found early enough. The chances for cure drop dramatically if the tumor has grown into the ureter wall or kidney or if it has a more aggressive (high grade) appearance when viewed under the microscope. After surgery, repeated visits to the doctor for monitoring with x-rays and cystoscopies (looking into the bladder) are extremely important because transitional cell carcinoma can come back in the bladder as well as other places in the body.

**Wilms' tumor:** About 5% to 6% of all kidney cancers are *Wilms' tumors*. This type of cancer is almost always found in children and is extremely rare among adults. Information on Wilms' tumor is available in the American Cancer Society document "Wilms' Tumor."

**Renal sarcoma:** *Renal sarcomas* are a rare type of kidney cancer (less than 1% of all kidney tumors) that begins within the kidney's connective tissue.

**Renal adenoma:** *Renal adenomas* are very small, slow growing, benign tumors that, under a microscope, look a lot like low grade renal cell carcinomas. In rare cases, tumors first thought to be renal adenomas may turn out to be small renal cell carcinomas.

**Oncocytoma:** *Oncocytomas* are a type of benign kidney tumor that is sometimes quite large. Because oncocytomas do not metastasize to other organs, they can often be cured by removing the kidney.

**Angiomyolipoma:** *Angiomyolipomas* are another rare benign kidney tumor. They often develop in people with tuberous sclerosis. For more information see the section "What Are the Risk Factors for Renal Cell Carcinoma?"

**The rest of this information refers only to renal cell carcinoma and not to transitional cell carcinomas, Wilms' tumors, renal sarcomas, renal adenomas, renal oncocytomas or other less common types of kidney tumors.**

## What Are The Key Statistics About Kidney Cancer (Renal Cell Carcinoma)?

The American Cancer Society estimates that there will be about 30,800 new cases of kidney cancer (18,700 in men and 12,100 in women) in the United States in the year 2001, and about 12,100 people (7,500 men and 4,600 women) will die from this disease. These statistics include both adults and children, and include renal cell carcinomas as well as transitional cell carcinomas of the renal pelvis. Renal cell carcinoma is the most common type of kidney cancer in adults while Wilms' tumor is the most common type of kidney cancer in children.

In about 50% of cases, the renal cell carcinoma has not spread outside the kidney when it is discovered. In another 25% of people the cancer will be found to have grown locally outside the kidney and in the remaining 25% it will have metastasized (spread farther away) to other parts of the body such as the lungs or bones.

The 5-year survival rate refers to the percent of patients who live at least five years after their cancer is diagnosed. Many of these patients live much longer than five years after diagnosis, and 5-year rates are used to produce a standard way of discussing prognosis. Of course, 5-year survival rates are based on patients diagnosed and initially treated more than five years ago. Improvements in treatment often result in a more favorable outlook for recently diagnosed patients. The 5-year survival rate is about 60% for all people diagnosed with renal cell carcinoma (including tumors that are localized and those that have metastasized). It will be higher for people with small tumors and lower for people who have large tumors that have grown outside the kidney. Refer to the section on "How is Kidney Cancer (Renal Cell Carcinoma) Treated?" for more detailed survival statistics.

## What Are The Risk Factors For Kidney Cancer (Renal Cell Carcinoma)?

A *risk factor* is anything that increases a person's chance of getting a disease such as cancer. Different cancers have different risk factors. For example, unprotected exposure to strong sunlight is a risk factor for skin cancer. Scientists have found several risk factors that make a person more likely to develop renal cell carcinoma.

### Lifestyle-Related and Job-Related Risk Factors

**Smoking:** Cigarette smoking increases the risk of developing renal cell carcinoma by anywhere from 30% to 100%; it may cause as much as one-third of renal cell carcinomas in men and one-fourth of those in women.

**Obesity:** A very overweight person has a much higher risk of developing renal cell cancer. Some doctors think obesity is a factor in 20% of people who get this cancer. Obesity may cause changes in certain hormones that can lead to renal cell carcinoma.

**Diet:** Well-cooked meat has been linked to renal cell carcinoma. People who eat adequate amounts of fruits and vegetables lower their risk for renal cell carcinoma.

**Occupational exposures:** Some studies suggest that workplace exposure to asbestos, cadmium (a type of metal), and organic solvents, particularly trichloroethylene, increases the risk of renal cell carcinoma.

### **Genetic and Hereditary Risk Factors**

Some people inherit a tendency to develop certain types of cancer. The DNA that a person inherits from their parents may have certain changes that account for this tendency to develop cancer. Sometimes, these DNA alterations also occur during fetal development inside the mother's womb. For more detailed information about these DNA alterations, refer to the section on "What Causes Kidney Cancer (Renal Cell Carcinoma)?" *Hereditary renal cell carcinoma* is caused by at least three different known inherited conditions:

**von Hippel-Lindau disease:** People with this condition often develop several kinds of tumors. Between 25% and 45% of these people develop renal cell carcinoma, usually the clear cell type. They may also have benign blood vessel tumors called hemangioblastoma in their eyes, brain, and spinal cord; cystic (fluid filled) growths in their pancreas and other organs; and a type of adrenal gland tumor called pheochromocytoma.

**Hereditary papillary renal cell carcinoma:** People with this condition have an inherited tendency to develop one or more papillary renal cell carcinomas, but do not have the other medical problems that affect people with von Hippel-Lindau disease.

**Hereditary renal oncocyoma:** There are some people who inherit the tendency to develop a kidney tumor with very low potential for being malignant, which is called an oncocyoma.

### **Other Risk Factors**

**Medications:** *Phenacetin*, once a popular non-prescription pain-reliever, has been linked to renal cell cancer in the past. Because this medication has not been available in the United States for over 20 years, this no longer appears to be a major risk factor. *Diuretics* (medications for treating high blood pressure and congestive heart failure that stimulate the kidneys to remove salt and fluid from the body) have also been linked to renal cell carcinoma, as has high blood pressure (which is often treated with diuretics). It is not clear whether these drugs or the disease is the cause, and people who need these drugs should not avoid diuretics to attempt to reduce the risk of renal cell carcinoma.

**Kidney disease:** People with advanced kidney disease who need to be on dialysis have a higher incidence of renal cell carcinoma. Dialysis is a treatment used to remove toxins from the body of people whose kidneys are not working properly.

**Age:** Most renal cell carcinomas occur in adults between the ages of 50-70 years. They are rare in children and young adults.

**Gender:** Renal cell carcinoma is about twice as common in men than in women. Men are more likely to be smokers and are more likely to be exposed to cancer-causing chemicals at work, which may account for the difference.

## **Do We Know What Causes Kidney Cancer (Renal Cell Carcinoma)?**

Researchers have found several important risk factors for renal cell carcinoma, and they are beginning to understand how these risk factors can alter the DNA of kidney cells in ways that cause these cells to become cancerous.

### **DNA and Gene Mutations**

For many years, scientists have asked why normal cells become cancerous. To understand how cancer cells develop, it is necessary to know something about genetics, the study of genes. A gene is a segment of DNA that has a recognizable biologic function. For example, genes determine eye color, skin color, blood type, and sometimes how we behave. Abnormal changes in the DNA of genes can sometimes influence what diseases we may get. These DNA changes are called *mutations*. Sometimes these mutations are inherited from a person's parents. This explains why certain diseases seem to be more common among some families. More often, mutations are not inherited but develop during a person's lifetime.

Genes are part of chromosomes, which are extremely long DNA (deoxyribonucleic acid) threads containing thousands of genes. This DNA is organized into 23 pairs of chromosomes. One of each pair is inherited from the mother and one is inherited from the father.

During the past few years, scientists have learned a lot about changes in chromosomes and genes that cause kidney cells to become cancerous. Some of these changes are inherited, and cause the conditions leading to hereditary (inherited) kidney cancer that are described in the section of this document entitled "What Are the Risk Factors for Kidney Cancer (Renal Cell Carcinoma)?" Sometimes these changes are not inherited, and occur after birth, possibly due to cancer-causing chemicals or other unknown causes.

Researchers have recently discovered the inherited gene mutations that cause von Hippel-Lindau disease. They are beginning to understand how changes in the von Hippel-Lindau (VHL) gene lead to renal cell carcinomas and other tumors that affect people with this condition. They have also learned that changes that occur in this gene after birth can lead to renal cell carcinomas without the other medical problems that affect people with von Hippel-Lindau disease. Scientists have also discovered the gene mutations that are responsible for hereditary papillary renal cell carcinoma. The affected gene, called the *met* oncogene, is part of chromosome number 7. The gene(s) mutation that causes familial oncocytoma is still not known.

Several other DNA, gene, and chromosome changes have been found in renal cell carcinomas. A lot of these cancers involve having too many copies of a particular chromosome. Many involve

mutations in tumor suppressor genes such as the p53 gene or the RB gene. (See American Cancer Society essay on "Heredity and Cancer").

Research in renal cell carcinoma continues to focus on how these DNA mutations result in kidney tumors. Doctors hope to use this information to develop drugs or vaccines to treat this cancer more effectively.

Progress has been made in understanding how tobacco increases a person's risk for developing renal cell carcinoma. Many of the cancer-causing chemicals in tobacco smoke are absorbed into the bloodstream by the lungs. Because the kidneys filter this blood, many of these chemicals become highly concentrated in the kidneys. Several of these chemicals are known to damage kidney cell DNA in ways that can cause the cells to become cancerous.

Obesity, another cause of this cancer, alters the body's hormonal balance. We are learning that hormones control the growth (both normal and abnormal) of many different tissues in the body including the kidneys.

### **Can Kidney Cancer (Renal Cell Carcinoma) Be Prevented?**

Certainly some cases of renal cell carcinoma can be prevented. Since cigarette smoking is responsible for as many as 30% of cases, stopping smoking can lower a person's risk. Obesity and diet are both related to renal cell cancer. Maintaining a healthy weight and eating adequate amounts of fruits and vegetables may also reduce a person's chance of getting this disease. Finally, avoiding workplace exposure to large amounts of harmful substances such as cadmium, asbestos, and organic solvents can reduce a person's risk for renal cell cancer.

### **Can Kidney Cancer (Renal Cell Carcinoma) Be Found Early?**

Many kidney cancers are found at a late stage; they can become quite large without causing any pain or discomfort. Because the kidney is deep inside the body, small kidney tumors cannot be seen or felt during a physical exam. There are no simple tests that can detect kidney cancer early. Routine urinalysis (urine tests that are often part of a complete medical checkup) may find small amounts of blood in the urine of some people with early renal cell carcinoma. However, there are many other causes of *hematuria* (blood in the urine), including urinary tract infections, *cystitis* (bladder infection), bladder cancer, and benign kidney conditions such as kidney stones. Some people with kidney cancer do not have blood in their urine until the cancer is quite large and may have spread to other parts of the body.

Imaging tests such as computed tomography (CT) scans and magnetic resonance imaging (MRI) can find small renal cell carcinomas. However, these imaging tests are relatively expensive and cannot always distinguish benign tumors from small renal cell carcinomas. For these reasons, CT and MRI are recommended for early detection of renal cell carcinoma in very few people who have certain risk factors such as von Hippel-Lindau disease.

It is important to tell your doctor if family members (blood relatives) have or have had kidney cancer or other disorders associated with von Hippel-Lindau disease. Genetic tests looking for the VHL gene mutation are available, but these tests are presently used to diagnose von Hippel-Lindau disease and not kidney cancer. Genetic testing for von Hippel-Lindau disease is used only in people with clinical signs of that condition and their blood relatives. Patients diagnosed with von Hippel-Lindau disease may need frequent CT or MRI scans to look for early kidney cancer. Genetic testing may also help find people with hereditary papillary renal cell carcinoma.

People with kidney diseases treated by long-term dialysis should have periodic tests (either CT or MRI scans) of their kidneys to look for kidney cancer at an early curable stage.

Often, kidney cancers are found "incidentally," meaning that the cancer is found during medical tests for some other illness such as gallbladder disease. It usually causes no pain or discomfort at the time of discovery. The survival rate for kidney cancer found this way is very high, because these cancers are usually found at a very early stage.

**Signs and symptoms of kidney cancer:** If you have any of the following problems, consult a doctor.

Blood in the urine (*hematuria*)

Low back pain on one side not associated with injury

A mass or lump in the *abdomen* (belly)

Fatigue

Weight loss that is not intentional

Fever that is not associated with a cold, flu, or other infection and that doesn't go away after a few weeks

Swelling of ankles and legs (*edema*)

These symptoms may indicate cancer, but more often are due to noncancerous diseases. For example, while blood cells in the urine may be a sign of kidney, bladder, or prostate cancer, it does not usually mean cancer. Most often, it is caused by a bladder infection or a kidney stone.

## **How Is Kidney Cancer (Renal Cell Carcinoma) Diagnosed?**

If there is a reason to suspect you may have kidney cancer, the doctor will use one or more methods to find out if the disease is present.

### **Medical History and Physical Exam**

The doctor takes a complete *medical history* to check for risk factors and symptoms. A physical exam can provide information about signs of kidney cancer and other health problems.

### **Imaging Tests**

Computed tomography scans, magnetic resonance imaging, intravenous pyelogram, and ultrasonography (also known as ultrasound) are very helpful in the diagnosis of most kinds of kidney tumors.

**Computed Tomography (CT or CAT scan):** A *CT scan* uses a rotating x-ray beam to create a series of pictures of the body from many angles. A computer combines these pictures to produce a detailed cross-sectional picture that can show a tumor. Injection of *contrast material* (a kind of dye that shows up on an x-ray) into a vein before CT scanning can help produce a clearer picture that can help the doctor find a kidney tumor.

CT scanning is one of the most useful tests in finding a mass inside the kidney. It is also useful in checking whether or not a cancer has spread to organs and tissues beyond the kidney. Recently CT scanning has been improved by a method called *helical scanning*. This is basically a rapid CT scan. When the contrast material is injected, the scan can show its passage through the kidney. This provides such a clear picture of the kidney that even small tumors can be seen.

**Ultrasonography (ultrasound or US):** *Ultrasonography* uses sound waves to produce images of internal organs. A *transducer* emits sound waves and detects the echoes bounced off internal organs. A computer processes the pattern of echoes to produce images. The echo patterns produced by most kidney tumors look different from those of normal kidney tissue. Different echo patterns also can distinguish some types of benign and malignant kidney tumors from one another.

**Magnetic Resonance Imaging (MRI):** An *MRI scan* uses radio waves and strong magnets instead of x-rays. Tissues of the body absorb energy from the radio waves. The energy is then released in a pattern that changes with the type of tissue and with certain diseases. A computer then translates the pattern of radio waves given off by tissues into a very detailed picture of parts of the body. MRI provides more detailed images than CT and US, and can also help doctors decide if the cancer has invaded one of the major blood vessels located near the kidney.

**Intravenous Pyelogram (IVP):** This is an older x-ray procedure where a special contrast dye, which shows up white on dark x-rays, is injected into a vein. The dye is concentrated in and secreted by the kidneys into the urine. IVP can help identify a cancer or show kidney damage caused by the tumor.

**Angiography:** Like the IVP, this test also uses a contrast dye. The dye is injected into an artery leading to the kidney to outline blood vessels. Because angiography can outline the blood vessels that supply a kidney tumor, it can help a surgeon plan an operation. Angiography also helps diagnose renal cancers since they have a special appearance with this test.

**Chest X-ray:** A *chest x-ray* is used to see if the cancer has spread to the lungs. The chest x-ray may also be used by your doctor to evaluate your general health and determine whether you might be able to tolerate certain treatments of kidney cancer such as immunotherapy or surgery.

**Bone Scan:** A *bone scan* uses small amounts of a special radioactive material that when injected into your blood stream can identify diseases, both cancerous and noncancerous, in bones. The levels of radiation used are very low and not harmful.

## Laboratory Tests

**Urinalysis:** About half of all patients with renal cell cancer will have blood in their urine. *Urinalysis* is usually part of a complete physical exam but may not be done as a part of more routine physicals. Microscopic and chemical tests are used so that small amounts of blood not seen with the naked eye can be found. Sometimes, special microscopic examination of urine samples (called urine cytology) will show actual cancer cells in the urine. Urine cytology detects transitional cell carcinoma more often than renal cell carcinoma.

**Blood Tests:** A complete blood count and chemical test of the blood can detect some findings associated with renal cell cancer. *Anemia* (too few red blood cells) is very common. *Polycythemia* (too many red blood cells) may occur because some of these cancers produce a hormone (erythropoietin) that increases red blood cell production by the bone marrow. High levels of enzymes released by the liver (for reasons not known) and *hypercalcemia* (high calcium levels) sometimes occur.

**Fine Needle Aspiration (FNA):** This test is rarely used to diagnose kidney tumors. A thin needle is used to remove fluid or small pieces of tissue from a kidney tumor or suspected metastatic site for examination under a microscope. Imaging studies usually provide enough information for the surgeon to decide whether or not an operation is needed. Fine needle aspiration is rarely valuable when imaging results are not conclusive enough to warrant removing a kidney. Or, if the doctors think the cancer has spread, they may biopsy the metastatic site and not the kidney. CT scans may be taken during the FNA procedure to help guide the needle into the tumor.

## How Is Kidney Cancer (Renal Cell Carcinoma) Staged?

*Staging* is the process of gathering information from examinations and diagnostic tests to determine how widespread a cancer is. The stage of a cancer is one of the most important factors in selecting treatment options.

Certain imaging tests such as a chest x-ray, intravenous pyelogram, CT scan, or ultrasound exam may be done. Blood tests may also be done to evaluate the patient's overall health and to detect whether the cancer has spread to certain organs.

A *staging system* is a standardized way in which the cancer care team describes the extent of the cancer. The Staging System of the American Joint Committee on Cancer (AJCC) is sometimes also known as the *TNM system*.

The letter **T** followed by a number from 1 to 3 describes the tumor's size and spread to nearby tissues. Higher T numbers indicate a larger tumor and/or more extensive spread to tissues near the kidney.

The letter **N** followed by a number from 0 to 2 indicates whether the cancer has spread to lymph nodes near the kidney and, if so, how many are affected. Lymph nodes are bean-sized collections of immune system cells that help fight infections and cancers.

The letter **M** followed by a 0 or 1 indicates whether or not the cancer has spread to distant organs (for example, the lungs or bones) or to lymph nodes that are not near to the kidneys.

Once a patient's T, N, and M categories have been determined, this information is combined in a process called *stage grouping* to determine a patient's disease stage. This is expressed in Roman numerals from stage I (the least serious or earliest stage) to stage IV (the most serious or advanced stage).

The next section is a more detailed discussion of specific T, N, and M categories and how they are grouped to determine a kidney cancer's stage.

### **Summary of Renal Cell Carcinoma AJCC (TNM) Stages**

**Stage I:** The tumor is 7 cm (about 2 ¾ inches) or smaller, and limited to the kidney. There is no spread to lymph nodes or distant organs.

**Stage II:** The tumor is larger than 7 cm but still limited to the kidney. There is no spread to lymph nodes or distant organs.

**Stage III:** There are several combinations of T and N categories that are included in this stage.

These include tumors with spread to one nearby lymph node, but without spread to distant lymph nodes or other organs.

Stage III also includes tumors with spread to fatty tissue around the kidney and/or spread into the large veins leading from the kidney to the heart, but that have not spread to any lymph nodes or other organs.

**Stage IV:** There are several combinations of T, N, and M categories that are included in this stage.

This stage includes any cancers that have spread directly through the fatty tissue and the *fascia*, the ligament-like tissue that surrounds the kidney.

Stage IV also includes any cancer that has spread to more than one lymph node near the kidney, to any lymph node not near the kidney, or to any other organs such as the lungs, bone, or brain.

## **Detailed Definitions of Renal Cell Carcinoma T, N, and M Categories**

### **Primary Tumor (T):**

TX: Primary tumor cannot be assessed (information not available)

T1: Tumor 7 cm (about 2 ¾ inches) or smaller, and limited to the kidney

T2: Tumor larger than 7 cm but still limited to the kidney

T3a: Tumor spread to fatty tissue around the kidney but not beyond Gerota's fascia (ligament-like tissue that surrounds the kidney and the fatty tissue next to the kidney)

T3b: Tumor spread into the renal vein (large vein leading out of the kidney) and/or the part of the vena cava (large vein leading into the heart) within the abdomen

T3c: Tumor spread through the renal vein (large vein leading out of the kidney) and has reached the part of the vena cava (large vein leading into the heart) within the chest

T4: Tumor spread beyond Gerota's fascia (ligament-like tissue that surrounds the kidney and the fatty tissue next to the kidney)

### **Regional Lymph Nodes (N):**

NX: Regional lymph nodes cannot be assessed (information not available)

N0: No regional lymph node metastasis

N1: Metastasis to one regional (nearby) lymph node

N2: Metastasis to more than one regional (nearby) lymph node

### **Distant Metastasis (M):**

MX: Presence of distant metastasis cannot be assessed (information not available)

M0: No distant metastasis

M1: Distant metastasis present; includes metastasis to non-regional (not near the kidney) lymph nodes and other organs (such as the lungs, bones, brain)

## **Renal Cell Cancer Stage Grouping**

	<b>T (Tumor)</b>	<b>N (Nodes)</b>	<b>M</b>
Stage I	T1	N0	M
Stage II	T2	N0	M
Stage III	T1	N1	M
	T2	N1	M
	T3a	N0	M
	T3a	N1	M
	T3b	N0	M
	T3b	N1	M
	T3c	N0	M
	T3c	N1	M
Stage IV	T4	N0	M
	T4	N1	M
	Any T	N2	M
	Any T	Any N	M

### **Robson Staging System for Renal Cell Carcinoma**

In addition to the AJCC or TNM staging system, an older system, the Robson classification, is still used sometimes: The cancer is confined to the kidney.

**Stage II:** The cancer has broken through the kidney capsule and spread into the fatty tissue immediately around the kidney and/or into the adrenal gland immediately above the kidney.

**Stage III:** The cancer has spread further into nearby lymph nodes and/or blood vessels.

**Stage IV:** The cancer has grown into a nearby organ or spread through the bloodstream to other organs (for example, lungs, liver, or bone).

### **How Is Kidney Cancer (Renal Cell Carcinoma) Treated?**

This information represents the views of the doctors and nurses serving on the American Cancer Society's Cancer Information Database Editorial Board. These views are based on their interpretation of renal cell carcinoma treatment studies published in medical journals, as well as their own professional experience. The treatment information in this document is not, however, official policy of the Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help patients and their families make informed decisions, together with their cancer care team. Of course, your cancer care team may have reasons for suggesting a treatment plan different from these general guidelines. Don't

hesitate to ask them questions about your treatment options. In addition to the information in this document, we encourage interested patients to seek out treatment information from other reliable sources.

Once your cancer has been diagnosed and staged, there is a lot to consider before you and your doctor choose a treatment plan. You may feel that you must make a decision quickly, but it is important to give yourself time to absorb the information you have just learned. Ask questions of your cancer care team. For examples of questions, read the section "What Questions Should You Ask Your Doctor About Kidney Cancer?"

You will want to weigh the benefits of each treatment against its possible side effects or risks. The treatment you choose should also take into account your health, age, and personal preferences, as well as the stage of your cancer.

You may want a second opinion about the best treatment option for your situation, especially if there are several choices available to you. A second opinion from someone who specializes in treating renal cancer can provide more information and help you feel more confident about the treatment plan that you choose.

This section begins with a summary of the types of treatments available to people with kidney cancer. The usual treatments for kidney cancers at each stage are then discussed.

## **Surgery**

Surgery is the main treatment for renal cell carcinoma. The chances of surviving a renal cell cancer without having surgery are poor. Depending on the type and stage, surgery may be used to remove the cancer together with some of the surrounding kidney tissue or the entire kidney. Usually, it is also necessary to remove the adrenal gland (small gland found attached above the each kidney). The surgeon can make the incision in several places. The most common sites are the middle of the abdomen, under the ribs on the same side as the cancer or even in the back, just behind the cancerous kidney. Each has its advantages in treating cancers of different sizes and in different locations in the kidney.

**Radical nephrectomy:** The most commonly performed operation to treat renal cell cancer is called a *radical nephrectomy*. Radical nephrectomy removes the whole kidney (along with its cancer), the attached adrenal gland, and the fatty tissue immediately around the kidney. *Regional lymphadenectomy* is sometimes done along with the radical nephrectomy. This procedure removes nearby lymph nodes. These nodes are used to help stage the cancer (Remember that staging is important when choosing treatment options and for predicting the patient's chances for survival).

**Partial nephrectomy:** This procedure, also called *nephron-sparing surgery* (from the Greek word nephros for kidney), does not remove the entire kidney. Instead, only the part of the kidney containing cancer is removed, leaving the rest of the organ behind. Partial nephrectomies are often done in patients with cancer in both kidneys, or in patients with only one kidney who develop renal cell cancer. More and more partial nephrectomies are being done in patients with

small renal cell cancers (smaller than 4 cm or about 1 3/4 inch) in one of their kidneys. The results have been very promising. The obvious benefit is that the patient loses only part of his or her kidney. Because there is a very small risk that some cancer may be left behind, most surgeons will only perform this surgery for these small cancers.

**Removal of metastases:** About one-fourth of patients with renal cell carcinoma will already have metastatic spread of their cancer when they are diagnosed. Sometimes surgically removing the metastases will temporarily relieve the pain and some other symptoms of metastatic disease, but this usually does not help patients live longer. In general, if there are many metastases, surgery to remove all or some of these is not recommended. However, surgery may be recommended if there is only one or if there are a few easily accessible metastases and they can be completely removed without causing serious side effects.

**Arterial embolization:** *Arterial embolization* is a technique that blocks the artery that feeds the kidney with the tumor. A very small *catheter* (tube) is placed in an artery in the groin and pushed through the vessel until it reaches the *renal artery* (the artery going from the aorta to the kidney). Material is then injected into the artery to block it. This procedure, while rarely performed, is sometimes done before nephrectomy to reduce bleeding during the operation.

**Risks of surgery:** Risks associated with surgery include:

bleeding during surgery or after surgery that may require blood transfusions  
wound infection

damage to internal organs and blood vessels (such as the spleen, pancreas, aorta, vena cava, large or small bowel) during surgery

*pneumothorax* (unwanted air in the chest cavity)

*incisional hernia* (bulging of internal organs underneath the surgical incision due to problems with wound healing)

kidney failure (if the remaining kidney fails to function well).

Some people can't have surgery because of poor health (heart or lung problems, for example).

For them, radiation therapy, arterial embolization of the cancer, or experimental chemotherapy or immunotherapy may be their best choices for kidney cancer treatment.

## **Chemotherapy**

Chemotherapy uses anticancer drugs that are given into a vein or by mouth (in pill form). These drugs enter the bloodstream and reach all areas of the body, which makes this treatment potentially useful for cancer that has spread (metastasized) to organs beyond the kidney.

Unfortunately, kidney cancer cells are very resistant to present forms of chemotherapy and there is no standard way to treat it with drugs. Some drugs, such as vinblastine, floxuridine, and 5-fluorouracil (5-FU) are mildly effective.

Chemotherapy drugs kill cancer cells but can also damage some normal cells. Therefore, careful attention is given to avoiding or minimizing side effects.

The side effects of chemotherapy depend on the type of drugs, the amount taken, and the length of treatment. Temporary side effects might include nausea and vomiting, loss of appetite, loss of hair, and mouth sores. Because chemotherapy can damage the blood-producing cells of the bone marrow, patients may have low blood cell counts. This can increase the chances of infection (due to a shortage of white blood cells), bleeding or bruising after minor cuts or injuries (due to a shortage of blood platelets), and fatigue (due to low red blood cell counts). Chemotherapy may cause changes in the menstrual cycle, and permanent or temporary damage to the ovaries or testicles that may result in *infertility* (not being able to have children).

Most side effects disappear once treatment is stopped. There are remedies for many of the temporary side effects of chemotherapy. For example, *antiemetic* drugs can be given to prevent or reduce nausea and vomiting. Some chemotherapy drugs have specific side effects that may be permanent. If you are taking chemotherapy, ask your doctor what side effects are likely, and what can be done to avoid or treat them.

### **Hormone Therapy**

Some doctors will treat patients with widespread renal cell carcinoma with a drug called Provera that acts like the female hormone progesterone. An occasional patient will show improvement with this treatment. It has few side effects except for some fluid retention and weight gain.

### **Radiation Therapy**

Radiation therapy uses high-energy radiation to kill cancer cells. *External beam therapy* focuses radiation from outside the body on the cancer. This type of therapy is sometimes used as the main treatment for kidney cancer for people whose general health is too poor to undergo surgery. Radiation therapy can also be used to temporarily *palliate*, or ease, symptoms of kidney cancer such as pain, bleeding, or problems caused by metastases. Unfortunately, renal cell carcinomas are not very sensitive to radiation. Use of radiation therapy before or after removing the cancer is not routinely recommended, because studies have shown no improvement in survival rates.

Side effects of radiation therapy may include mild skin changes (similar to sunburn), nausea, diarrhea, or tiredness. Often these go away after a short while. Radiation may also make the side effects of chemotherapy worse. Radiation therapy to the chest area may cause lung damage and lead to breathing difficulty and shortness of breath. Side effects of radiation to the brain usually become most serious one or two years after treatment, and can include headaches and difficulty thinking.

### **Immunotherapy**

Conventional chemotherapy has not been very successful in treating metastatic renal cell carcinoma. A lot of attention is now being focused on *immunotherapy*, a relatively new approach to treat this cancer. The goal of immunotherapy is to boost the body's immune system to more effectively fight off or destroy cancer cells. There are several types of immunotherapy used to treat patients with metastatic renal cell carcinoma.

The use of drugs called cytokines (proteins that activate the immune system) has become one of the standard treatments for metastatic renal cell carcinoma. The two cytokines most often used are interleukin-2 (IL-2) and interferon-alpha. Both cytokines cause these cancers to shrink to less than half their original size in about 20% of patients. Patients who respond to IL-2 tend to have lasting responses. Combining low doses of both cytokines seems to be at least as effective as high dose IL-2, with fewer and less severe side effects. Recent research with a combination of IL-2, interferon, and chemotherapy (using 5-fluorouracil) is also promising, and may offer some patients a better chance of partial or complete remission (little or no remaining cancer detectable by imaging tests).

The possible side effects of cytokine therapy include:

- low blood pressure
- fluid accumulation in the lungs
- kidney damage
- heart attacks
- intestinal bleeding
- high fever and chills

These side effects are often severe and, rarely, can be fatal. For this reason, only doctors experienced in the use of these cytokines should give this treatment to people with renal cell carcinoma.

Cytokines are also used to stimulate immune system cells that have been removed from the patient. These immune system cells are usually obtained from circulating blood. After being mixed with the cytokines in the laboratory, the activated immune system cells are then returned to the patient's blood-stream. The stimulated immune cells then seek out and attack the cancer cells.

Renal cell carcinoma tumors contain cancer cells as well as immune system cells that fight the cancer cells. These immune system cells are called *tumor-infiltrating lymphocytes*. Some studies indicate that cytokine-activated cells from the tumor fight renal cell carcinoma better than the cytokine-activated immune cells from the bloodstream.

## **Pain Control**

Pain is a significant concern for some patients with advanced kidney cancer. It is important that patients take advantage of treatments that can relieve their pain. Unless the doctor is made aware of the pain, he or she can't help. For most patients, treatment with morphine or other so-called *opioids* (medications related to opium) will reduce the pain considerably. For the treatment to be effective, the pain medicines must be taken on a regular schedule, not just when the pain becomes severe. Several long-acting forms of morphine and other long-acting opioid drugs (narcotics) have been developed that need only be given once or twice a day.

## **Clinical Trials**

Studies of promising new or experimental treatments in patients are known as clinical trials. A clinical trial is only done when there is some reason to believe that the treatment being studied may be of value to the patient. Treatments used in clinical trials are often found to have real benefits. There are three phases of clinical trials in which a treatment is studied before the treatment is eligible for approval by the FDA (Food and Drug Administration).

The purpose of a Phase I study is to find the best way to give a new treatment and to determine how much of it can be given safely. Physicians watch patients carefully for any harmful side effects. The research treatment has been well tested in laboratory and animal studies, but the side effects in patients are not completely predictable.

After safety has been evaluated in a Phase I trial, Phase II trials determine the effectiveness of a research treatment. Patients are closely observed for an anticancer effect by careful measurement of cancer sites present at the beginning of the trial. In addition to monitoring patients for response, any side effects are carefully recorded and assessed.

Phase III trials normally require large numbers (usually hundreds) of patients. One group of patients may receive the standard (most accepted) treatment, while another group is given the new treatment. The group that receives the standard treatment is called the "control group." This allows scientists to directly compare the two treatments in similar groups of people to determine which treatment is most effective and which will cause the fewest side effects. All patients in Phase III trials are monitored closely for side effects, and treatment is discontinued if the side effects are too severe.

Researchers conduct studies of new treatments to answer the following questions:

- Is the treatment likely to be helpful?
- Does this new type of treatment work?
- Does it work better than other treatments already available?
- What side effects does the treatment cause?
- Do the benefits outweigh the risks, including side effects?
- In which patients is the treatment most likely to be helpful?

However, there are some risks. No one involved in the study knows in advance whether the treatment will work or exactly what side effects will occur. That is what the study is designed to discover. While most side effects will disappear in time, some can be permanent or even life threatening. Keep in mind that even standard treatments have side effects. Depending on many factors, a patient may decide that a clinical trial will be helpful.

Enrollment in any clinical trial is completely voluntary. Before a patient decides to participate in a clinical trial, the doctor or nurse will explain the study to him or her in detail. The patient is then given a form to read and sign indicating his or her desire to take part in the study. This process is known as giving *informed consent*. Even after signing the form and after the clinical trial begins, the patient is free to leave the study at any time, for any reason. Taking part in the study does not prevent a person from getting other medical care they may need.

To find out more about clinical trials, ask your cancer care team. Among the questions you should ask are:

- What is the purpose of the study?
- What kinds of tests and treatments does the study involve?
- What does this treatment do?
- What is likely to happen in my case with, or without, this new research treatment?
- What are my other choices? What are their advantages and disadvantages?
- How could the study affect my daily life?
- What side effects can I expect from the study? Can the side effects be controlled?
- Will I have to be hospitalized? If so, how often and for how long?
- Will the study cost me anything? Will any of the treatment be free?
- If I were harmed as a result of the research, what treatment would I be entitled to?
- What type of long-term follow-up care is part of the study?
- Has the treatment been used to treat other types of cancers?

To find out more about clinical trials, you may want to ask your doctor if he or she knows of any trials for which you would be a good candidate. You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll free at 1-800-4-CANCER or visiting the NCI clinical trials website for patients ([cancertrials.nci.nih.gov](http://cancertrials.nci.nih.gov)) or health care professionals ([cancernet.nci.nih.gov/prot/protsrch.shtml](http://cancernet.nci.nih.gov/prot/protsrch.shtml)).

## **Complementary and Alternative Methods**

If you are considering any alternative or complementary treatments, discuss it openly with your cancer care team and request information from the American Cancer Society or the National Cancer Institute. Some unproven treatments can interfere with standard medical treatments or may cause serious side effects.

## **Treatment Choices by Stage**

**Stage I or stage II:** Patients with stage I or II renal cell carcinoma usually have their cancers surgically removed. Patients with smaller, stage I tumors can have either radical or partial nephrectomy. For the larger, stage II tumors, radical nephrectomy is more likely than partial nephrectomy to be curative. *Adjuvant* (additional) chemotherapy, radiation therapy, or immunotherapy after surgery for stage I or stage II renal cell carcinoma is not recommended. Patients who are unable to tolerate kidney surgery because of other serious medical problems are often treated by radiation therapy or selective arterial embolization. Although these treatments may slow tumor growth, they do not cure the cancer. With appropriate treatment, the 5-year survival rate for stage I patients is between 90% and 100% and the 5-year survival rate for stage II patients is between 65% and 75%.

**Stage III:** Radical nephrectomy and regional lymphadenectomy are the most common treatments for stage III cancer. Sometimes, a patient will have an arterial embolization procedure to reduce the amount of bleeding during nephrectomy. If the cancer has grown into nearby veins or even spread inside these veins to reach the heart, the surgeon may cut open these veins, remove the

cancer, and repair the vein. The 5-year survival rate for stage III patients varies widely (because there are so many different combinations of T and N categories grouped together within this stage) and is between 40% and 70%.

**Stage IV:** Stage IV renal cell carcinoma has spread too far away from the kidney to be cured by surgery. If the patient's general health is good enough to withstand the side effects of cytokine therapy, this option offers the best opportunity and is now considered standard therapy by many doctors. Clinical trials of new forms of immunotherapy, combined immunotherapy and chemotherapy, new chemotherapy drugs, and other new therapies are also options. For some patients, palliative treatments such as embolization or radiation therapy may be the best treatment. Some doctors like to use Provera as the first treatment because it has so few side effects.

When only a few metastases are present and it is possible to remove them without creating serious side effects, an aggressive surgical approach to removing the kidney tumor and these metastases may cure some people or help them live longer. The 5-year survival for stage IV patients is less than 10%. Radiation therapy may be given for brain metastases. A special form of radiation therapy, called *stereotactic radiosurgery* or the *gamma knife*, can be very effective in treating single brain metastases. This treatment uses highly focused beams of radiation.

### **Recurrent Renal Cell Carcinoma**

As for stage IV renal cell carcinoma, cytokine immunotherapy, chemotherapy, or clinical trials of new treatments are the best options for patients able and willing to tolerate the side effects. Radiation therapy can be used to reduce symptoms of some metastases. Appropriate treatment of pain is an important way of maintaining quality of life. It is important to realize that medications to relieve pain do not interfere with other treatments, and that there are new approaches to pain medication that do not prevent a patient from being alert and active. In fact, controlling pain often helps people with cancer to be more active and continue their usual activities.

### **What Should You Ask Your Doctor About Kidney Cancer (Renal Cell Carcinoma)?**

It is important to have frank, open discussions with your cancer care team. They want to answer all of your questions, no matter how trivial they might seem. For instance, consider these questions:

- What kind of kidney cancer do I have?
- Do you think my cancer has spread beyond the primary site?
- What is the stage of my cancer and what does that mean in my case?
- What treatment choices do I have?
- What do you recommend and why?
- Based on what you've learned about my cancer, what is my long-term prognosis?
- What risks or side effects are there to the treatments you suggest?

- What are the chances of recurrence of my cancer with these treatment plans?
- What should I do to be ready for treatment?
- How soon should I be treated?

In addition to these sample questions, be sure to write down some of your own. For example, you might want more information about how long it might take to recover, so you can plan your work schedule. Or, you may want to ask about second opinions or about clinical trials for which you may qualify.

## **What Happens After Treatment For Kidney Cancer (Renal Cell Carcinoma)?**

Each type of treatment for renal cell carcinoma could have side effects that may last from a few months to many years. A patient may be able to hasten his or her recovery by being aware of those side effects before treatment begins and by taking steps to minimize them and shorten their duration where possible after treatment.

From the start, keep in mind that you must deal with your own individual physical and emotional factors. In the process of deciding what kind of treatment to have, for instance, you may find it helpful to discuss options with your family and friends, as well as with your primary care physician and nurse. At every step of the way in pre-treatment, treatment, and recovery, you should talk with your cancer care team about side effects, ways to make them easier to endure, and your general prognosis (the outlook for chances of survival).

Your body is as unique as your personality and your fingerprints. Scientists can determine certain facts about tumors and drugs, and doctors can use a variety of treatments to eliminate the cancer. But no one can say precisely how you will respond to cancer or its treatment.

You may have special strengths such as a healthy immune system, a history of excellent nutrition, a strong family support system, or a deep faith. All of these strengths can make a difference in how you respond to cancer.

**Follow-up Tests:** Your doctor will decide which tests you should have and how often based on your cancer's original stage and response to treatment. Chest x-rays, CT scans of the abdomen and chest, and other imaging studies may be taken to watch for a local recurrence, metastasis, or for a new tumor. Blood tests to check kidney and liver function may also be requested.

**New Symptoms:** It is important to report any new symptoms to the doctor right away. These may be the first indication of recurrent cancer or of some side effects of treatment. In either case, the problem can be treated best if it is recognized early.

**Lifestyle Factors:** You can help in your own recovery from cancer by making healthy lifestyle choices.

If you use tobacco, stop now. Quitting will improve your overall health and the full return of your sense of smell may help you enjoy a healthy diet during recovery.

If you use alcohol, limit how much you drink. Have no more than one or two drinks per day.

Good nutrition can help you get better after treatment. Eat a well balanced diet and maintain a healthy weight. Researchers are also finding increasing evidence of the importance of nutrition in the prevention of cancer. Eat more fruits, vegetables, whole grains, and high-fiber foods. Eat less animal fat. Discuss your diet with your health care team.

Exercise once you are well. Ask your cancer care team whether your cancer or its treatments might limit your exercise program or other activities.

If you are being treated for cancer, be aware of the battle that is going on in your body. Radiation therapy and chemotherapy add to the fatigue caused by the disease itself. Give your body all the rest it needs so that you will feel better as time goes on.

A cancer diagnosis and its treatment are major life challenges, and it affects you and everyone who cares for you. Before you get to the point where you feel overwhelmed, consider attending a meeting of a local support group. If you need individual assistance in other ways, contact your hospital's social service department or the American Cancer Society for help in contacting counselors or other services.

## **What's New In Kidney Cancer (Renal Cell Carcinoma) Research And Treatment?**

There is always research going on in the area of kidney cancer. Scientists are looking for causes and ways to prevent renal cell carcinoma. Doctors are working to improve treatments as part of a major effort to lower the number of people who die from this cancer.

Research on the treatments for renal cell carcinoma is now being done at many medical centers, university hospitals, and other institutions across the nation. The American Cancer Society supports research into the detection, diagnosis, and treatment of kidney cancer.

**Genetics:** Scientists are studying several genes that may play a part in changing normal kidney cells into renal cell carcinoma. In one approach, scientists are trying to replace the defective VHL gene with a normal one. Other researchers are testing whether replacing another gene, the p53 gene, can change cancer cells to normal ones. Most of the work so far has been done in the laboratory. The hope is that eventually, doctors may be able to add normal genes back into renal cell carcinoma cells to reverse their cancerous behavior.

**Immunotherapy:** Clinical trials of new immunotherapy methods are being tested. Studies to find the best doses of cytokines that are effective but have minimal side effects are also in progress. Basic research directed toward a better understanding of the immune system, how to activate it, and how it reacts to cancer, is expected to lead to increasingly powerful immunotherapy.

**Stem cell transplantation:** *Stem cells* in the bone marrow develop into blood cells and into immune system cells capable of attacking cancerous cells. In *stem cell transplantation*, these cells are separated from the bone marrow or bloodstream of the patient (or of a compatible donor). The patient is treated with high-dose chemotherapy and then is injected with the stem cells. The transplanted stem cells replace the patient's own bone marrow stem cells, which have been destroyed by the high-dose chemotherapy treatment. Without the donor stem cells, the patient would be unable to produce new blood cells and immune system cells, and might die of infections.

Transplanted stem cells from a donor also become immune to the patient's tissues. In a recent study, doctors decided to see whether donated immune system cells given along with the stem cells would slow or stop the spread of kidney cancer metastases. Patients were given small doses of chemotherapy drugs to suppress their immune systems, so their bodies would not reject the donated immune system cells. The low dose chemotherapy did not completely destroy their bone marrow cells, so the side effects and risks of the procedure were reduced. The researchers then treated the patients with injections of stem cells and immune system cells donated by a sibling (brother or sister) or an unrelated donor with a compatible tissue type. Some of the patients also received additional injections of immune system cells later on. Although conventional therapy no longer worked for any of these patients, this new treatment caused the tumors to shrink or disappear in 10 out of 19 patients. The tumors were apparently eliminated in three patients. Two patients died of complications from the treatment and others had side effects including rashes and intestinal pain, but the much longer than normal survival of most patients is very encouraging to researchers. More research is needed before the therapy will be available outside of clinical trials, however.

**Tumor vaccines:** Researchers are now working on a new approach to immunotherapy that uses *tumor vaccines*. This involves genetically adding genes (segments of DNA) to a patient's cancer cells that can be activated to produce *cytokines*. After a cancer is removed, scientists add these genes to kidney cancer cells in the laboratory and then inject the altered cells back into the patient. Adding cytokines to cancer cells identifies them as a target for the patient's immune system. Without this treatment, the body's immune system is rarely effective at recognizing renal cell carcinoma well enough to completely destroy the tumor. But after this treatment, the immune system may begin to better recognize the altered cancer cells and even the unaltered cancer cells remaining in the patient's body. This approach is being tested in very early stages, and it is not yet known if it will be more effective than standard immunotherapy with cytokines.

**Chemotherapy:** The drugs that are currently available are not very effective against renal cell carcinoma. New drugs are being developed and tested with the intention of finding more effective treatments. Basic research into understanding why this cancer is so resistant to chemotherapy is expected to provide answers that will help develop new chemotherapy treatments.

**New approaches to treatment:** Several new approaches to cancer treatment are being used in renal cell cancer. These include antiangiogenesis drugs (which kill cancers by stopping their blood supply) and anti-growth factor drugs (which interfere with substances some cancer cells produce to stimulate their own growth). New surgical approaches using extreme cold

(cryosurgery) or extreme heat (microwave thermotherapy) are also presently being tested in clinical trials to determine their effectiveness in treating small localized renal cell cancers.

## **Additional Resources**

### **National Organizations and Web Sites**

In addition to the American Cancer Society, other sources of patient information and support include\*:

National Cancer Institute  
Telephone: 1-800-4-CANCER  
Internet Address: [www.nci.nih.gov](http://www.nci.nih.gov) and [cancer.net.nci.nih.gov](http://cancer.net.nci.nih.gov)

National Coalition for Cancer Survivorship  
Telephone: 1-888-650-9127  
Internet Address: [www.cansearch.org](http://www.cansearch.org)

National Kidney Cancer Association  
Telephone: 1-800-850-9132 or 1-847-332-1051  
[www.nkca.org](http://www.nkca.org)

VHL (Von Hippel-Lindau disease) Family Alliance  
Telephone: 1-800-767-4845 or 1-617-277-5667;  
Fax: 1-617-734-8233  
Internet Address: [www.vhl.org](http://www.vhl.org)

*\*Inclusion on this list does not imply endorsement by the American Cancer Society*

### **Additional American Cancer Society Information**

After Diagnosis: A Guide for Patients and Families (Booklet; Code #9440.00)

Caring for the Patient with Cancer at Home (Booklet; Code #4656.00)

Questions and Answers About Pain Control (Booklet; Code #4518.00)

### **Other Publications\***

*\*Inclusion on this list does not imply endorsement by the American Cancer Society*

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