Kidney Cancer (Adult) - Renal Cell Carcinoma

What is cancer?

The body is made up of trillions of living cells. Normal body cells grow, divide into new cells, and die in an orderly fashion. During the early years of a person's life, normal cells divide faster to allow the person to grow. After the person becomes an adult, most cells divide only to replace worn-out or dying cells or to repair injuries.

Cancer begins when cells in a part of the body start to grow out of control. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells can also invade (grow into) other tissues, something that normal cells cannot do. Growing out of control and invading other tissues are what makes a cell a cancer cell.

Cells become cancer cells because of damage to DNA. DNA is in every cell and directs all its actions. In a normal cell, when DNA gets damaged the cell either repairs the damage or the cell dies. In cancer cells, the damaged DNA is not repaired, but the cell doesn't die like it should. Instead, this cell goes on making new cells that the body does not need. These new cells will all have the same damaged DNA as the first cell does.

People can inherit damaged DNA, but most DNA damage is caused by mistakes that happen while the normal cell is reproducing or by something in our environment. Sometimes the cause of the DNA damage is something obvious, like cigarette smoking. But often no clear cause is found.

In most cases the cancer cells form a tumor. Some cancers, like leukemia, rarely form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

Cancer cells often travel to other parts of the body, where they begin to grow and form new tumors that replace normal tissue. This process is called *metastasis*. It happens when the cancer cells get into the bloodstream or lymph vessels of our body.

No matter where a cancer may spread, it is always named for the place where it started. For example, breast cancer that has spread to the liver is still called breast cancer, not liver cancer. Likewise, prostate cancer that has spread to the bone is metastatic prostate cancer, not bone cancer.

Different types of cancer can behave very differently. For example, lung cancer and breast cancer are very different diseases. They grow at different rates and respond to different treatments. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

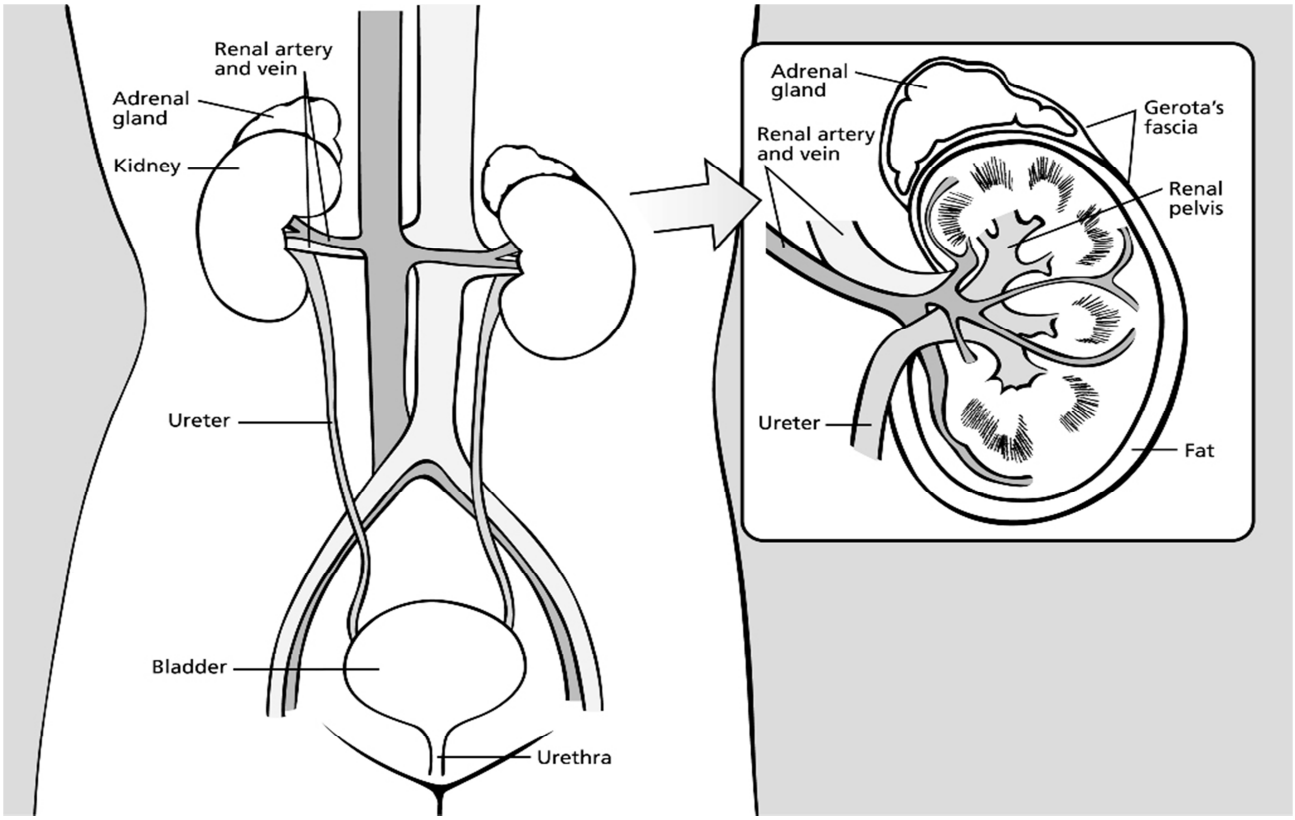
Not all tumors are cancerous. Tumors that aren't cancer are called benign. Benign tumors can cause problems – they can grow very large and press on healthy organs and tissues. But they cannot grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body (metastasize). These tumors are almost never life threatening.

What is kidney cancer?

To understand more about kidney cancer, it helps to know about the normal structure and function of the kidneys.

About the kidneys

The kidneys are a pair of bean-shaped organs, each about the size of a fist and weighing about 4 to 5 ounces. They are fixed to the upper back wall of the abdominal cavity, one on either side of the spine. Both are protected by the lower ribcage.



The kidneys' main job is to filter the blood to remove excess water, salt, and waste products. These substances become urine. Urine travels from the kidneys to the bladder through long slender tubes called *ureters.* The place where the ureter meets the kidney is called the *renal pelvis*. The urine is stored in the bladder until you urinate (pee).

The kidneys also help make sure the body has enough red blood cells. They do this by making a hormone called *erythropoietin*, which tells the bone marrow to make more red blood cells.

Our kidneys are important, but we actually need less than one complete kidney to function. Many 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*. The most common form of dialysis uses a specially designed machine that filters blood much like a real kidney would.

Renal cell carcinoma

Renal cell carcinoma (RCC), also known as *renal cell cancer* or *renal cell adenocarcinoma*, is by far the most common type of kidney cancer. About 9 out of 10 kidney cancers are renal cell carcinomas.

Although RCC usually grows as a single mass (tumor) within a kidney, sometimes there are 2 or more tumors in one kidney or even tumors in both kidneys at the same time. Some of these cancers are noticed only after they have become quite large, but most are

found before they metastasize (spread) to distant organs in the body. Often they are found on CT scans or ultrasounds that are being done for concerns other than kidney cancer. Like most cancers, RCC is hard to treat once it has spread.

There are several subtypes of RCC, based mainly on how the cancer cells look under a microscope. Knowing an RCC subtype can be a factor in deciding treatment and can also help your doctor determine if your cancer may be due to an inherited genetic syndrome.

Clear cell renal cell carcinoma

This is the most common form of renal cell carcinoma. About 7 out of 10 people with renal cell carcinoma have this kind of cancer. When seen under a microscope, the cells that make up clear cell RCC look very pale or clear.

Papillary renal cell carcinoma

This is the second most common subtype - about 1 case in 10 is this type. These cancers form little finger-like projections (called *papillae*) in some, if not most, of the tumor. Some doctors call these cancers *chromophilic* because the cells take in certain dyes and look pink under the microscope.

Chromophobe renal cell carcinoma

This subtype accounts for about 5% (5 cases in 100) of RCCs. 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.

Collecting duct renal cell carcinoma

This subtype is very rare. The major feature is that the cancer cells can form irregular tubes.

Unclassified renal cell carcinoma

Rarely, renal cell cancers are labeled as unclassified because the way they look doesn't fit into any of the other categories or because there is more than one type of cell present.

Other cancerous kidney tumors

Other types of kidney cancers include transitional cell carcinomas, Wilms tumors, and renal sarcomas.

Transitional cell carcinoma

Of every 100 cancers in the kidney, about 5 to 10 are transitional cell carcinomas, also known as *urothelial carcinomas*. Transitional cell carcinomas don't start in the kidney

itself, but instead begin in the lining of the renal pelvis (where the urine goes before it enters the ureter). This lining is made up of cells called *transitional cells* that look like the cells that line the bladder. When cancer develops from these cells they look like other urothelial carcinomas, such as bladder cancer, under the microscope. Studies have shown that, like bladder cancer, these cancers are often linked to cigarette smoking and being exposed to certain cancer-causing chemicals in the workplace.

People with transitional cell carcinoma often 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 the portion of the bladder where the ureter attaches. Smaller, less aggressive cancers can sometimes be treated with less surgery. Chemotherapy (chemo) is sometimes given after surgery, depending on how much cancer is found. The chemo given is the same as that used for bladder cancer. It's important to talk with your doctor to be aware of your options and the benefits and risks of each treatment.

About 9 out of 10 transitional cell carcinomas of the kidney are curable if they are found at an early stage. The chances for cure drop dramatically if the tumor has grown into the ureter wall or main part of the kidney or if it has a more aggressive (high grade) appearance when seen under a microscope.

After treatment, follow-up visits to your doctor for monitoring with cystoscopy (looking into the bladder with a lighted tube) and imaging tests are extremely important because transitional cell carcinoma can come back in the bladder, as well as other places in the body.

For more information about transitional cell carcinoma, see our document, *Bladder Cancer*.

Wilms tumor (nephroblastoma)

Nephroblastomas, more commonly called *Wilms tumors*, almost always occur in children. This type of cancer is very rare among adults. To learn more about this type of cancer, see our document, *Wilms Tumor*.

Renal sarcoma

Renal sarcomas are a rare type of kidney cancer (less than 1% of all kidney tumors) that begin in the blood vessels or connective tissue of the kidney. Sarcomas are discussed in more detail in our document, *Sarcoma- Adult Soft Tissue Cancer*.

Benign (non-cancerous) kidney tumors

Some kidney tumors are benign (non-cancerous). This means they do not metastasize (spread) to other parts of the body, although they can still grow and cause problems. Benign kidney tumors include renal cell adenomas, renal oncocytomas, and angiomyolipomas. They can be treated by removing or destroying the tumor, using many

of the procedures that are also used for kidney cancers, such as radical nephrectomy, partial nephrectomy, radiofrequency ablation, and arterial embolization. The choice of treatment is influenced by many factors, such as the size of the tumor and if it is causing any symptoms, the number of tumors, whether tumors are present in both kidneys, and the patient's general health.

Renal adenoma

Renal adenomas are the most common benign kidney tumors. They are small, slow-growing tumors that often show up on imaging tests (such as CT scans) when the doctor is looking for something else. Seen with a microscope, they 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. Because they are hard to tell apart, suspected adenomas are often treated like renal cell cancers.

Oncocytoma

Oncocytomas are benign kidney tumors that can sometimes grow quite large. As with renal adenomas, it can sometimes be hard to tell them apart from kidney cancers. Because oncocytomas do not normally spread to other organs, surgery often cures them.

Angiomyolipoma

Angiomyolipomas are another rare benign kidney tumor. They often develop in people with tuberous sclerosis, a genetic condition that also affects the heart, eyes, brain, lungs, and skin. These tumors are made up of different types of connective tissues (blood vessels, smooth muscles, and fat). If they aren't causing any symptoms, they can often just be watched closely. If they start causing problems (like pain or bleeding), they may need to be treated.

The rest of this document focuses on renal cell carcinoma and not transitional cell carcinomas, Wilms tumors, renal sarcomas, or other less common types of kidney tumors.

What are the key statistics about kidney cancer?

The American Cancer Society's most recent estimates for kidney cancer in the United States for 2013 are:

- About 65,150 new cases of kidney cancer (40,430 in men and 24,720 in women) will occur.
- About 13,680 people (8,780 men and 4,900 women) will die from this disease.

These statistics include both renal cell carcinomas and transitional cell carcinomas of the renal pelvis.

Most people with this cancer are older. The average age of people when they are diagnosed is 64. Kidney cancer is very uncommon in people younger than age 45, and it most often occurs in people 55 and older.

Kidney cancer is among the 10 most common cancers in both men and women. Overall, the lifetime risk for developing kidney cancer is about 1 in 63 (1.6%). This risk is higher in men than in women. A number of other factors (described in the section, "What are the risk factors for kidney cancer?") also affect a person's risk.

For reasons that are not totally clear, the rate of people developing kidney cancer has been rising steadily since the late 1990s. Part of this is probably due to the development of newer imaging tests such as CT scans, which have picked up some cancers that might never have been found otherwise. The death rates for these cancers have gone down slightly since the middle of the 1990s.

Survival rates for people diagnosed with kidney cancer are discussed in the section, "How is kidney cancer staged?"

What are the risk factors for kidney cancer?

A risk factor is anything that affects your 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.

But risk factors don't tell us everything. Having a risk factor, or even several risk factors, does not mean that you will get the disease. And some people who get the disease may not have had any known risk factors. Even if a person with kidney cancer has a risk factor, it is often very hard to know how much that risk factor contributed to the cancer.

Scientists have found several risk factors that could make you more likely to develop kidney cancer.

Lifestyle-related and job-related risk factors

Smoking

Smoking increases the risk of developing renal cell carcinoma. The increased risk seems to be related to how much you smoke. The risk drops if you stop smoking, but it takes many years to get to the risk level of someone who never smoked.

Obesity

People who are very overweight have a higher risk of developing renal cell cancer. Some doctors think obesity is a factor in about 2 out of 10 people who get this cancer. Obesity may cause changes in certain hormones that can lead to renal cell carcinoma.

Workplace exposures

Many studies have suggested that workplace exposure to certain substances increases the risk for renal cell carcinoma. Some of these substances are asbestos, cadmium (a type of metal), some herbicides, benzene, and organic solvents, particularly trichloroethylene.

Genetic and hereditary risk factors

Some people inherit a tendency to develop certain types of cancer. The DNA that you inherit from your parents may have certain changes that give you this tendency to develop cancer. Some rare inherited conditions can cause kidney cancer. It is important that people who have hereditary causes of renal cell cancer see their doctors frequently, particularly if they have already had a renal cell cancer diagnosed. Some doctors recommend regular imaging tests (such as CT scans) for these people.

People who have the conditions listed here have a much higher risk for getting kidney cancer, although they account for only a small portion of cases overall:

von Hippel-Lindau disease

People with this condition often develop several kinds of tumors and cysts (fluid-filled sacs) in different parts of the body. They have an increased risk for developing clear cell renal cell carcinoma, especially at a younger age. They may also have benign tumors in their eyes, brain, spinal cord, pancreas and other organs; and a type of adrenal gland tumor called *pheochromocytoma*. This condition is caused by mutations (changes) in the *VHL* gene.

Hereditary papillary renal cell carcinoma

People with this condition have inherited a tendency to develop one or more papillary renal cell carcinomas, but they do not have tumors in other parts of the body, as is the case with the other inherited conditions listed here. This disorder is linked to changes in many genes, most often the *MET* gene.

Hereditary leiomyoma-renal cell carcinoma

People with this syndrome develop smooth muscle tumors called *leiomyomas* (fibroids) of the skin and uterus (in women) and have a higher risk for developing papillary renal cell cancers. It has been linked to changes in the fumarate hydratase (*FH*) gene.

Birt-Hogg-Dube (BHD) syndrome

People with this syndrome develop many small benign skin tumors and have an increased risk of developing different kinds of kidney tumors, including renal cell cancers and oncocytomas. They may also have benign or malignant tumors of several other tissues. The gene linked to BHD is known as folliculin (*FLCN*).

Familial renal cancer

People with this syndrome develop tumors called *paragangliomas* of the head and neck region, as well as tumors known as *pheochromocytomas* of the adrenal glands and other areas. They also tend to get kidney cancer in both kidneys before age 40. It is caused by defects in the genes *SDHB* and *SDHD* (succinate dehydrogenase subunit B and D, respectively).

These gene defects can also cause something called *Cowden-like syndrome*. People with this syndrome have a high risk of breast, thyroid and kidney cancers.

Hereditary renal oncocytoma

Some people inherit the tendency to develop a kidney tumor called oncocytoma, which has a very low potential for being malignant.

Other risk factors

Family history of kidney cancer

People with a strong family history of renal cell cancer (without one of the known inherited conditions listed previously) also have a 2 to 4 times higher chance of developing this cancer. This risk is highest in brothers or sisters of those with the cancer. It's not clear whether this is due to shared genes or something that both people were exposed to in the environment − or both.

High blood pressure

The risk of kidney cancer is higher in people with high blood pressure. Some studies have suggested that certain medicines used to treat high blood pressure may raise the risk of kidney cancer, but it is hard to tell if it's the condition or the medicine (or both) that may be the cause of the increased risk.

Certain medicines

Phenacetin, once a popular non-prescription pain reliever, has been linked to renal cell cancer in the past. Because this medicine has not been available in the United States for over 20 years, this no longer appears to be a major risk factor.

Diuretics: Some studies have suggested that diuretics (water pills) may be linked to a small increase in the risk of renal cell carcinoma. It is not clear whether the cause is the drugs or the high blood pressure they treat. If you need diuretics, you should take them. You shouldn't avoid them to try to reduce the risk of kidney cancer.

Advanced kidney disease

People with advanced kidney disease, especially those needing dialysis, have a higher risk of renal cell carcinoma. Dialysis is a treatment used to remove toxins from your body if the kidneys do not work properly.

Gender

Renal cell carcinoma is about twice as common in men as 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 some of the difference.

Race

African Americans have a slightly higher rate of renal cell cancer. The reasons for this are not clear.

Do we know what causes kidney cancer?

Although many risk factors may increase the chance of developing kidney cancer, it is not yet known exactly how some of these risk factors cause kidney cells to become cancerous.

Changes (mutations) in genes

Researchers are beginning to understand how certain changes in DNA can cause normal kidney cells to become cancerous. DNA is the chemical in each of our cells that makes up our genes − the instructions for how our cells function. We usually look like our parents because they are the source of our DNA. However, DNA affects more than how we look.

Some genes control when our cells grow, divide, and die. Certain genes that speed up cell division and stop cells from dying when they are supposed to are called *oncogene*s. Others that slow down cell division, or cause cells to die at the right time, are called *tumor suppressor genes*. Cancers can be caused by DNA mutations (changes) that "turn on" oncogenes or "turn off" tumor suppressor genes.

Inherited gene mutations

Certain *inherited* DNA changes can lead to conditions running in some families that increase the risk of kidney cancer. These syndromes, which cause a small portion of all

kidney cancers, were described in the section, "What are the risk factors for kidney cancer?"

For example, *VHL*, the gene that causes von Hippel-Lindau (VHL) disease, is a tumor suppressor gene. It normally helps keep cells from growing out of control. Mutations (changes) in this gene can be inherited from parents, causing von Hippel-Lindau disease. When the *VHL* gene is mutated, it is no longer able to suppress abnormal growth, and kidney cancer is more likely to develop. The genes linked to hereditary leiomyoma and renal cell carcinoma (the *FH* gene), Birt-Hogg-Dube syndrome (the *FLCN* gene), and familial renal cancer (*SDHB* and *SDHD*) are also tumor suppressor genes, and inherited changes in these genes also lead to an increased risk of kidney cancer.

People with hereditary papillary renal cell carcinoma have inherited changes in the *MET* oncogene that cause it to be "turned on" all the time. This can lead to uncontrolled cell growth and makes the person more likely to develop papillary renal cell cancer.

Acquired gene mutations

Most DNA mutations related to kidney cancer, however, occur during a person's life rather than having been inherited. These *acquired* changes in oncogenes and/or tumor suppressor genes may result from factors such as exposure to cancer-causing chemicals (like those found in tobacco smoke), but in many cases what causes these changes is not known.

About 3 out of 4 people with sporadic (non-inherited) clear cell renal cancer have changes in the *VHL* gene that cause it not to function properly. These changes were acquired during life rather than being inherited.

Other gene changes may also cause renal cell carcinomas. Researchers continue to look for these changes.

Progress has been made in understanding how tobacco increases the risk for developing renal cell carcinoma. Your lungs absorb many of the cancer-causing chemicals in tobacco smoke into the bloodstream. Because your 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 risk factor for this cancer, alters the balance of some of the body's hormones. Researchers are now learning how certain hormones help control the growth (both normal and abnormal) of many different tissues in the body, including the kidneys.

What is known about the gene changes that lead to kidney cancer is being used to help develop new treatments for this disease. For example, researchers now know that the *VHL* gene normally stops cells from making a substance called *vascular endothelial growth factor* (VEGF). Tumors need new blood vessels to survive and grow and VEGF causes new blood vessels to form. Newer drugs that target VEGF are now being used to treat kidney cancer. They are described in the section, “Targeted therapies for kidney cancer.”

Can kidney cancer be prevented?

In many cases, the cause of kidney cancer is not known. In some other cases (such as with inherited conditions that raise kidney cancer risk), even when the cause is known it may not be preventable.

But there are some ways you may be able to reduce your risk of this disease. Cigarette smoking is responsible for a large percentage of cases, and stopping smoking may lower your risk. Obesity and high blood pressure are also risk factors for renal cell cancer. Maintaining a healthy weight by exercising and choosing a diet high in fruits and vegetables, and getting treatment for high blood pressure may also reduce your chance of getting this disease. Finally, avoiding workplace exposure to large amounts of harmful substances such as cadmium, asbestos, and organic solvents may reduce your risk for renal cell cancer as well.

Can kidney cancer be found early?

Although many kidney cancers are found fairly early, while they are still confined to the kidney, others are found at a more advanced stage. There are a few reasons for this:

- These cancers can sometimes become quite large without causing any pain or other problems.
- Because the kidneys are deep inside the body, small kidney tumors cannot be seen or felt during a physical exam.
- There are no recommended screening tests for kidney cancer in people who are not at increased risk.

A routine urine test (urinalysis), which is sometimes part of a complete medical checkup, may find small amounts of blood in the urine of some people with early renal cell cancer. But this test is not a good way to look for kidney cancer. Many things other than kidney cancer cause blood in the urine, including urinary tract infections, bladder infections, bladder cancer, and benign (non-cancerous) kidney conditions such as kidney stones. Also, some people with kidney cancer do not have blood in their urine until the cancer is quite large and might have spread to other parts of the body.

Imaging tests such as computed tomography (CT) scans and magnetic resonance imaging (MRI) scans can find small renal cell carcinomas. But these tests are expensive and cannot always tell benign tumors from small renal cell carcinomas.

For these reasons, doctors generally recommend CT and MRI for early detection of kidney cancer only in people who have inherited conditions that raise their risk of kidney cancer, such as von Hippel-Lindau disease. Some doctors also recommend that people with kidney diseases treated by long-term dialysis have periodic tests (CT or MRI scans) to look for kidney cancer.

Ultrasound is less expensive and may also detect early kidney cancer. However, to recommend screening tests for people without risk factors or symptoms of a cancer, studies have to show the test improves survival. No imaging tests screening for kidney cancer have done this.

Often, kidney cancers are found incidentally (by accident) during tests for some other illness such as gallbladder disease. These cancers usually are causing no pain or discomfort when they are discovered. The survival rate for kidney cancer found this way is very high because these cancers are usually found at a very early stage.

Genetic tests for inherited conditions linked to kidney cancer

It is important to tell your doctor if family members (blood relatives) have or had kidney cancer, especially at a younger age, or if they have been diagnosed with an inherited condition linked to this cancer, such as von Hippel-Lindau disease. Your doctor may recommend that you consider genetic testing. Only people who have clinical signs of these conditions or blood relatives with these clinical signs are genetically tested for these conditions.

Before having genetic tests, it's important to talk with a genetic counselor so that you understand what the tests can − and can't − tell you, and what any results would mean. Genetic tests look for the gene mutations that cause these conditions in your DNA. They are used to diagnose these inherited conditions, not kidney cancer itself. Your risk may be increased if you have one of these conditions, but it does not mean that you have (or definitely will get) kidney cancer. For more information on genetic testing, see the separate document, *Genetic Testing: What You Need to Know*.

If you have been diagnosed with one of these conditions, you might need frequent CT or MRI scans to look for early kidney cancer.

How is kidney cancer diagnosed?

Signs and symptoms of kidney cancer

Unfortunately, early kidney cancers do not usually cause any signs or symptoms, but larger ones might. Some possible signs and symptoms of kidney cancer include:

- Blood in the urine (hematuria)
- Low back pain on one side (not caused by injury)
- A mass (lump) on the side or lower back
- Fatigue (tiredness)
- Weight loss not caused by dieting
- Fever that is not caused by an infection and that doesn't go away after a few weeks

- Anemia (low red blood cell counts)

These symptoms may be caused by cancer, but more often they are caused by other, benign, diseases. For example, blood in the urine can be a sign of kidney, bladder, or prostate cancer, but most often it is caused by a bladder infection or a kidney stone. Still, if you have any of these symptoms, consult a doctor so that the cause can be evaluated and treated, if needed.

Medical history and physical exam

If you have any signs or symptoms that suggest you might have kidney cancer, your doctor will want to take 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. For example, the doctor may be able to feel an abnormal mass when he or she examines your abdomen.

If symptoms and/or the results of the physical exam suggest kidney cancer might be present, more tests will probably be done. These might include imaging tests and/or lab tests.

Lab tests

Lab tests cannot be used to diagnose kidney cancer, but they can sometimes give the first hint that there may be a kidney problem. They are also done to get a sense of a person's overall health and to help tell if cancer may have spread to other areas. They also can help show if a person is healthy enough to have an operation.

Urinalysis

Urinalysis (urine testing) is sometimes part of a complete physical exam, but it may not be done as a part of more routine physicals. This test may be done if your doctor suspects a kidney problem.

Microscopic and chemical tests are done on a urine sample to look for small amounts of blood and other substances not seen with the naked eye. About half of all patients with renal cell cancer will have blood in their urine. If the patient has an urothelial carcinoma (in the renal pelvis, the bladder, or other parts of the urinary tract), sometimes special microscopic examination of urine samples (called *urine cytology*) will show actual cancer cells in the urine.

Complete blood count

The complete blood count (CBC) is a test that measures the different cells in the blood, such as red blood cells, white blood cells, and platelets. This test result is often abnormal in people with renal cell cancer. Anemia (having too few red blood cells) is very common. Less often, a person may have too many red blood cells (called *polycythemia*) because the kidney cancer makes a hormone (erythropoietin) that causes the bone marrow

to make more red blood cells. Blood counts are also important to make sure a person is healthy enough for surgery.

Blood chemistry tests

Blood chemistry tests are usually done in people who might have kidney cancer, because the cancer can affect the levels of certain chemicals in the blood. For example, high levels of liver enzymes are sometimes found. High blood calcium levels may indicate that cancer has spread to the bones, and may therefore prompt a doctor to order a bone scan. Blood chemistry tests also look at kidney function, which is especially important if certain imaging tests are planned.

Imaging tests

Imaging tests use x-rays, magnetic fields, or radioactive substances to create pictures of the inside of your body. Imaging tests are done for a number of reasons, including to help find out whether a suspicious area might be cancerous, to learn how far cancer may have spread, and to help determine if treatment has been effective.

Unlike most other cancers, doctors can often diagnose a kidney cancer fairly certainly without a biopsy (removal of a sample of the tumor to be looked at under a microscope). Often, imaging tests can give doctors a reasonable amount of certainty that a kidney mass is (or is not) cancerous. In some patients, however, a biopsy may be needed to be sure.

Computed tomography (CT) scans, magnetic resonance imaging (MRI) scans, and ultrasound can be very helpful in diagnosing most kinds of kidney tumors, although patients rarely need all of these tests. Other tests described here, such as chest x-rays and bone scans, are more often used to help determine if the cancer has spread (metastasized) to other parts of the body.

Computed tomography (CT) scan

The computed tomography (CT or CAT) scan is an x-ray that produces detailed cross-sectional images of your body. Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer then combines these pictures into images of slices of the part of your body being studied.

A CT scanner has been described as a large donut, with a narrow table in the middle opening. You will need to lie still on the table while the scan is being done. CT scans will take longer than regular x-rays and you might feel a bit confined by the ring while the pictures are being taken.

Before any pictures are taken, you may be asked to drink 1 to 2 pints of a liquid called oral contrast. This helps outline the intestine so that certain areas are not mistaken for tumors. You may also receive an IV (intravenous) line through which a different kind of contrast dye (IV contrast) is injected. This helps better outline structures in your body.

The injection may cause some flushing (a feeling of warmth, especially in the face). Some people are allergic and get hives. Rarely, more serious reactions like trouble breathing or low blood pressure can occur. Be sure to tell the doctor if you have ever had a reaction to any contrast material used for x-rays.

CT contrast can damage the kidneys. This happens more often in patients whose kidneys are not working well in the first place. Because of this, your kidney function will be checked with a blood test before you get IV contrast.

CT scanning is one of the most useful tests for finding and looking at a tumor inside your kidney. It is also useful in checking to see if a cancer has spread to organs and tissues beyond the kidney. The CT scan will provide precise information about the size, shape, and position of a tumor, and can help find enlarged lymph nodes that might contain cancer.

Magnetic resonance imaging (MRI) scan

Like CT scans, magnetic resonance imaging (MRI) scans provide detailed images of soft tissues in the body. But MRI scans use radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of body tissue and by certain diseases. A computer translates the pattern into a very detailed image of parts of the body. A contrast material called gadolinium is often injected into a vein before the scan to better see details. This contrast material isn't used in people on dialysis, because in those people it can rarely cause a severe side effect called *nephrogenic systemic fibrosis*.

MRI scans are a little more uncomfortable than CT scans. First, they take longer − often up to an hour. Second, you have to lie inside a narrow tube, which is confining and can upset people with claustrophobia (a fear of enclosed spaces). Special, open MRI machines can sometimes help with this if needed, but the drawback is that the pictures may not be as clear. MRI machines also make buzzing and clicking noises that many people find disturbing. Some centers provide headphones with music to block this noise out.

MRI scans are used less often than CT scans in people with kidney cancer. They may be done in cases where CT scans aren't practical, such as if a person can't have the CT contrast dye, such as when they have an allergy to it or they don't have good kidney function. MRI scans may also be done if there's a chance that the cancer has grown into major blood vessels in the abdomen (like the inferior vena cava), because they provide a better picture of blood vessels than CT scans. Finally, they may be used to look for possible spread of cancer to the brain or spinal cord if a person has symptoms that suggest this might be the case.

Ultrasound or ultrasonography

Ultrasound uses sound waves to create images of internal organs. For this test, a small, microphone-like instrument called a transducer is placed on the skin near the kidney after a gel is applied. The transducer gives off sound waves and picks up the echoes as they

bounce off the tissues in the kidney. The echoes are converted by a computer into a black and white image that is displayed on a computer screen. This test is painless and does not expose you to radiation.

Ultrasound can help determine if a kidney mass is solid or filled with fluid. 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. If a kidney biopsy is needed, this test can be used to guide a biopsy needle into the mass to obtain a sample.

Positron emission tomography (PET) scan

In a positron emission tomography (PET) scan, a form of radioactive sugar (known as *fluorodeoxyglucose* or *FDG*) is injected into the blood. The amount of radioactivity used is very low. Because cancers use glucose (sugar) at a higher rate than normal tissues, the radioactivity will tend to concentrate in the cancer. A scanner can spot the radioactive deposits and can create a picture of areas of radioactivity in the body. The picture is not finely detailed like a CT or MRI scan, but it provides helpful information about your body.

This test can be helpful for spotting small collections of cancer cells and can be useful in seeing if the cancer has spread to lymph nodes near the kidney. PET scans can also be useful if your doctor thinks the cancer may have spread but doesn't know where. PET scans can be used instead of several different x-rays because they scan your whole body.

Special machines can perform both a PET and CT scan at the same time (PET/CT scan). This lets the radiologist compare areas of higher radioactivity (suggesting an area of cancer) on the PET with the appearance of that area on the CT. Still, PET and PET/CT scans are not a standard part of the work-up for kidney cancers.

Intravenous pyelogram

An intravenous pyelogram (IVP) is an x-ray of the urinary system taken after a special dye is injected into a vein. The kidneys remove the dye from the bloodstream and it then concentrates in the ureters and bladder. An IVP can be useful in finding abnormalities of the renal pelvis and ureter, such as cancer, but this test is not often used when kidney cancer is suspected.

Angiography

This type of x-ray also uses a contrast dye, although not the same as the one used for an IVP. A catheter is usually threaded up a large artery in your leg into the artery leading to your kidney (renal artery). The dye is then injected into the artery to identify and map the blood vessels that supply a kidney tumor. This can help in planning surgery for some patients. Angiography can also help diagnose renal cancers since the blood vessels usually have a special appearance with this test. Angiography can be done as a part of the CT or MRI scan, instead of as a separate test. This means less contrast dye is used, which

is helpful since the dye can damage kidney function further if it is given to people whose kidneys don't work as well as they should.

Chest x-ray

If kidney cancer has been diagnosed (or is suspected), your chest may be x-rayed to see if cancer has metastasized (spread) to your lungs. Spread to the lungs is not very likely unless the cancer is far advanced. This x-ray can be done in any outpatient setting. If the results are normal, you probably don't have cancer in your lungs. The lungs are a common site of kidney cancer metastasis. Still, if your doctor has reason to suspect lung metastasis (based on symptoms like shortness of breath or a cough), you may have a chest CT scan instead of a regular chest x-ray.

Bone scan

A bone scan can help show whether a cancer has metastasized (spread) to your bones. For this test, a small amount of low-level radioactive material is injected into a vein (intravenously, or IV). The substance settles in areas of damaged bone throughout the entire skeleton in a couple of hours. You then lie on a table for about 30 minutes while a special camera detects the radioactivity and creates a picture of your skeleton.

Areas of active bone changes appear as "hot spots" on your skeleton − that is, they attract the radioactivity. These areas might suggest the presence of cancer spread, but arthritis or other bone diseases can also cause the same pattern. To distinguish between these conditions, your cancer care team may use other imaging tests such as simple x-rays or MRI scans to get a better look at the areas that light up, or they may even take biopsy samples of the bone.

Bone scans are done mainly when there is reason to think the cancer may have spread to the bones (like when the patient is having bone pain or blood test results show an increased calcium level). PET scans can usually show the spread of cancer to bones as well, so if you've had a PET scan you might not need a bone scan.

Fine needle aspiration and needle core biopsy

Biopsies are not often used to diagnose kidney tumors. Imaging studies usually provide enough information for a surgeon to decide if an operation is needed. However, a biopsy is sometimes used to get a small sample of cells from an area that may be cancer when the results of imaging tests are not definite enough to warrant removing a kidney. Biopsy may also be done to confirm a cancer diagnosis if a person may not be treated with surgery, such as with small tumors that will be watched and not treated, or when other treatments are being considered (this is discussed in more detail in the section, “How is kidney cancer treated?”).

Fine needle aspiration (FNA) and needle core biopsy are 2 types of kidney biopsies that may be done. For these types of biopsies a needle is put through the skin to take a sample of cells (called *percutaneous* biopsy).

For either type of biopsy, the skin where the needle is to be inserted is first numbed with local anesthesia. The doctor directs the biopsy needle into the area while looking at your kidney with either ultrasound or CT scans. Unlike ultrasound, CT doesn't provide a continuous picture, so the needle is inserted in the direction of the mass, a CT image is taken, and the direction of the needle is guided based on the image. This is repeated a few times until the needle is within the mass.

For FNA, a small sample of the target area is sucked (aspirated) through the needle into a syringe. The needle used for FNA biopsy is thinner than the ones used for routine blood tests. The needle used in core biopsies is larger than that used in FNA biopsy. It removes a small cylinder of tissue (about 1/16- to 1/8-inch in diameter and ½-inch long). Either type of sample is checked under the microscope to see if cancer cells are present.

In cases where the doctors think kidney cancer may have spread to other sites, they may take a sample of the metastatic site instead of the kidney.

Fuhrman grade

The Fuhrman grade is found by looking at kidney cancer cells (taken during a biopsy or during surgery) under a microscope. Many doctors use it to describe how aggressive the cancer is likely to be. The grade is based on how closely the cancer cells' nuclei (part of a cell in which DNA is stored) look like those of normal kidney cells.

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 (outcome). 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 a prognosis (outlook), 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 staged?"

How is kidney cancer staged?

Staging is the process of finding out how far a cancer has spread. Your treatment and prognosis (outlook) depend, to a large extent, on the cancer's stage.

Staging is based on the results of the physical exam, biopsies, and imaging tests (CT scan, chest x-ray, PET scan, etc.), which are described in the section, "How is kidney cancer diagnosed?"

There are actually 2 types of staging for kidney cancer. The *clinical stage* is your doctor's best estimate of the extent of your disease, based on the results of the physical exam, lab tests, and any imaging studies you have had. If you have surgery, your doctors can also determine the *pathologic stage*, which is based on the same factors as the clinical stage, plus what is found during surgery and examination of the removed tissue. This means

that if you have surgery, the stage of your cancer might actually change afterward (if cancer were found to have spread further than was suspected, for example). Pathologic staging is likely to be more accurate than clinical staging, because it allows your doctor to get a firsthand impression of the extent of your disease.

AJCC (TNM) staging system

A staging system is a standardized way in which the cancer care team describes the extent of the cancer. The most commonly used staging system is that of the American Joint Committee on Cancer (AJCC), sometimes also known as the TNM system. The TNM system describes 3 key pieces of information:

- **T** indicates the size of the main (primary) **tumor** and whether it has grown into nearby areas.
- **N** describes the extent of spread to nearby (regional) lymph **nodes**. Lymph nodes are small bean-shaped collections of immune system cells that are important in fighting infections.
- **M** indicates whether the cancer has spread (**metastasized**) to other organs of the body. (The most common sites of spread are to the lungs, bones, liver, and distant lymph nodes.)

Numbers or letters appear after T, N, and M to provide more details about each of these factors. The numbers 0 through 4 indicate increasing severity. The letter X means "cannot be assessed because the information is not available."

T categories for kidney cancer

TX: The primary tumor cannot be assessed (information not available).

T0: No evidence of a primary tumor.

T1: The tumor is only in the kidney and is 7 cm (a little less than 3 inches) or less across

- **T1a:** The tumor is 4 cm (about 1 1/2inches) across or smaller and is only in the kidney.
- **T1b:** The tumor is larger than 4 cm but not larger than 7 cm across and is only in the kidney.

T2: The tumor is larger than 7 cm across but is still only in the kidney.

- **T2a:** The tumor is more than 7 cm but not more than 10 cm (about 4 inches) across and is only in the kidney
- **T2b:** The tumor is more than 10 cm across and is only in the kidney

T3: The tumor is growing into a major vein or into tissue around the kidney, but it is not growing into the adrenal gland (on top of the kidney) or beyond Gerota's fascia (the fibrous layer that surrounds the kidney and nearby fatty tissue).

- **T3a:** The tumor is growing into the main vein leading out of the kidney (renal vein) or into fatty tissue around the kidney
- **T3b:** The tumor is growing into the part of the large vein leading into the heart (vena cava) that is within the abdomen.
- **T3c:** The tumor has grown into the part of the vena cava that is within the chest or it is growing into the wall of that blood vessel (the vena cava).

T4: The tumor has spread beyond Gerota's fascia (fibrous layer that surrounds the kidney and nearby fatty tissue). The tumor may have grown into the adrenal gland (on top of the kidney).

N categories for kidney cancer

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

N0: No spread to nearby lymph nodes.

N1: Tumor has spread to nearby lymph nodes.

M categories for kidney cancer

M0: There is no spread to distant lymph nodes or other organs.

M1: Distant metastasis is present; includes spread to distant lymph nodes and/or to other organs. Kidney cancer most often spreads to the lungs, bones, liver, or brain.

Stage grouping

Once the T, N, and M categories have been assigned, this information is combined to assign an overall stage of I, II, III, or IV. The stages identify cancers that have a similar prognosis and thus are treated in a similar way. Patients with lower stage numbers tend to have a better prognosis.

Stage I: T1, N0, M0

The tumor is 7 cm across or smaller and is only in the kidney (T1). There is no spread to lymph nodes (N0) or distant organs (M0).

Stage II: T2, N0, M0

The tumor is larger than 7 cm across but is still only in the kidney (T2). There is no spread to lymph nodes (N0) or distant organs (M0).

Stage III: Either of the following:

T3, N0, M0: The tumor is growing into a major vein (like the renal vein or the vena cava) or into tissue around the kidney, but it is not growing into the adrenal gland or beyond Gerota's fascia (T3). There is no spread to lymph nodes (N0) or distant organs (M0).

T1 to T3, N1, M0: The main tumor can be any size and may be outside the kidney, but it has not spread beyond Gerota's fascia. The cancer has spread to nearby lymph nodes (N1) but has not spread to distant lymph nodes or other organs (M0).

Stage IV: Either of the following:

T4, any N, M0: The main tumor is growing beyond Gerota's fascia and may be growing into the adrenal gland on top of the kidney (T4). It may or may not have spread to nearby lymph nodes (any N). It has not spread to distant lymph nodes or other organs (M0).

Any T, Any N, M1: The main tumor can be any size and may have grown outside the kidney (any T). It may or may not have spread to nearby lymph nodes (any N). It has spread to distant lymph nodes and/or other organs (M1).

Other staging and prognostic systems

The TNM staging system is useful, but some doctors have pointed out that there are factors other than the extent of the cancer that should be considered when determining prognosis and treatment.

University of California Los Angeles (UCLA) Integrated Staging System

This is a more complex system that came out in 2001. It was meant to improve upon the AJCC staging that was then in place. Along with the stage of the cancer, it takes into account a person's overall health and the Fuhrman grade of the tumor. These factors are combined to divide people into low-, intermediate-, and high-risk groups. Ask your doctor if he or she uses this system and how it might apply to you. In 2002, researchers at UCLA published a study evaluating their system, looking at survival rates of the low-, intermediate- and high-risk groups. For patients with localized kidney cancer (cancer not spread to distant organs) they found 5-year survival rates of 91% for low-risk groups, 80% for intermediate groups, and 55% for high-risk groups.

Survival predictors

Stage of disease is a predictor of survival. Researchers have linked certain factors with shorter survival times in people with kidney cancer that has spread outside the kidney. These include:

- High blood lactate dehydrogenase (LDH) level
- High blood calcium level
- Anemia (low red blood cell count)

- Cancer spread to 2 or more distant sites
- Less than a year from diagnosis to the need for systemic treatment (targeted therapy, immunotherapy, or chemotherapy)
- Poor performance status (a measure of how well a person can do normal daily activities)

People with none of the above factors are considered to have a good prognosis; 1 or 2 factors are considered intermediate prognosis, and 3 or more of these factors are considered to have a poor prognosis (outlook) and may be more or less likely to benefit from certain treatments.

Survival rates for kidney cancer by TNM stage

Survival rates are often used by doctors as a standard way of discussing a person's prognosis (outlook). Some patients with cancer may want to know the survival statistics for people in similar situations, while others may not find the numbers helpful, or may even not want to know them. If you decide that you don’t want to know them, stop reading here and skip to the next section.

The 5-year survival rate refers to the percentage of patients who live at least 5 years after their cancer is diagnosed. Of course, many people live much longer than 5 years (and many are cured). Also, some people die from causes other than their cancer.

In order to get 5-year survival rates, doctors have to look at people who were treated at least 5 years ago. Improvements in treatment since then may result in a more favorable outlook for people now being diagnosed with kidney cancer.

Survival rates are often based on previous outcomes of large numbers of people who had the disease, but they cannot predict what will happen in any particular person's case. Many other factors may affect a person's outlook, such as the grade of the cancer, the treatment received, and the patient’s age and overall health. Your doctor can tell you how the numbers below may apply to you, as he or she is familiar with your situation.

The numbers below come from the National Cancer Data Base and are based on patients first diagnosed in the years 2001 and 2002. These are *observed* survival rates. They include people diagnosed with kidney cancer who may have later died from other causes, such as heart disease. People with kidney cancer tend to be older and may have other serious health conditions. Therefore, the percentage of people surviving the cancer itself is likely to be higher.

Stage	5-Year Survival Rate
I	81%
II	74%
III	53%
IV	8%

How is kidney cancer 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 studies published in medical journals, as well as their own professional experience.

The treatment information in this document is not 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 you and your family make informed decisions, together with your doctor.

Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

The first part of this section describes the various types of treatments used for kidney cancer. This is followed by a description of the most common approaches used for these cancers based on the stage of the cancer.

Making treatment decisions

After the cancer is found and staged, your cancer care team will discuss your treatment options with you. It is important to take time and think about your possible choices. In choosing a treatment plan, one of the most important factors is the stage of the cancer. Other factors to consider include your overall health, the likely side effects of the treatment, and the probability of curing the disease, extending life, or relieving symptoms.

If you have kidney cancer, your treatment options may include:

- Surgery
- Ablation and other local therapies
- Active surveillance

- Radiation therapy
- Targeted therapy
- Immunotherapy (biologic therapy)
- Chemotherapy

These treatments might also be used together, depending on the factors mentioned. In considering your treatment options it is often a good idea to seek a second opinion, if possible. This may provide you with more information and help you feel more confident about the treatment plan you have chosen.

Surgery for kidney cancer

Surgery is the main treatment for most renal cell carcinomas. The chances of surviving a renal cell cancer without having surgery are small. Even patients whose disease has spread to other organs may benefit from surgery to take out the kidney tumor. Depending on the stage and location of the cancer and other factors, surgery may be used to remove either the cancer along with some of the surrounding kidney tissue, or the entire kidney. The adrenal gland (the small gland that sits on top of each kidney) and fatty tissue around the kidney may be removed as well.

Radical nephrectomy

In this operation, the surgeon removes your whole kidney, the attached adrenal gland, and the fatty tissue around the kidney. (Most people do just fine with only the one remaining kidney.)

The surgeon can make the incision in several places. The most common sites are the middle of the abdomen (belly), under the ribs on the same side as the cancer, or even in the back, just behind the cancerous kidney. Each approach has its advantages in treating cancers of different sizes and in different locations in the kidney. Although removing the adrenal gland is a part of a standard radical nephrectomy, the surgeon may be able to leave it behind in some cases where the cancer is in the lower part of the kidney and is far away from the adrenal gland.

If the tumor has grown from the kidney through the renal vein (the large vein leading away from the kidney) and into the inferior vena cava (a large vein that empties into the heart), the heart may need to be stopped for a short time in order to remove the tumor. The patient is put on cardiopulmonary bypass (a heart-lung machine) that circulates the blood while bypassing the heart. If you need this, a heart surgeon will work with your urologist during your operation.

Laparoscopic nephrectomy: This approach to radical nephrectomy has quickly become a preferred method for removing kidney tumors.

The operation is done through several small incisions instead of one large one. Special long instruments are inserted through the incisions, each of which is about 1/2-inch long,

to perform the operation. One of the instruments, the laparoscope, is a long tube with a small video camera on the end. This allows the surgeon to see inside the abdomen. Usually, one of the incisions has to be made longer in order to remove the kidney (although it's not as long as the incision for a standard nephrectomy).

This approach can be used to treat most renal tumors that cannot be treated with nephron-sparing surgery (see below). In experienced hands, the technique is as effective as open radical nephrectomy and usually means a shorter hospital stay, a faster recovery, and less pain after surgery. This may not be an option for large tumors (those larger than10 cm [4 inches]) and tumors that have grown into the renal vein or spread to lymph nodes around the kidney.

Partial nephrectomy (nephron-sparing surgery)

In this procedure, the surgeon removes only the part of the kidney containing cancer, leaving the rest of the organ behind. As with a radical nephrectomy, the surgeon can make the incision in several places, depending on factors like the location of the tumor.

At first, this approach was only used when there was a reason not to remove the entire kidney. This included people with cancer in both kidneys, those who only had one kidney and developed cancer in that kidney, and people who already had reduced kidney function for some other reason. It was also used in people who were likely to develop cancer in the other kidney in the future, such as those with von Hippel-Lindau disease and other hereditary forms of kidney cancer.

This type of surgery is now the preferred treatment for patients with early stage kidney cancer. It is often done to remove single small tumors (those less than 4 cm across), and can be done in patients with larger tumors (up to 7 cm across). Studies have shown the long-term results to be about the same as those when the whole kidney is removed. The obvious benefit is that the patient keeps more of their kidney function. A partial nephrectomy may not be an option if the tumor is in the middle of the kidney or is very large, if there is more than one tumor in the same kidney, or if the cancer has spread to the lymph nodes or distant organs. Not all doctors are able to do this type of surgery. It should only be done by someone with a lot of experience doing this procedure.

Some doctors can even do this procedure laparoscopically or using a robot. But again, this is a difficult operation, and it should only be done by a surgeon with a great deal of experience in this procedure.

Regional lymphadenectomy (lymph node dissection)

This procedure removes nearby lymph nodes to see if they contain cancer. Some doctors do this along with the radical nephrectomy, although not all doctors agree that it is always necessary. Most doctors agree that the lymph nodes should be removed if they are enlarged based on imaging tests or how they look during the operation. Some doctors also remove these lymph nodes to check them for cancer spread even when they aren’t enlarged, in order to better stage the cancer. Before surgery, ask your doctor if he or she plans to remove the lymph nodes near the kidney.

Removal of an adrenal gland (adrenalectomy)

Although this is a standard part of a radical nephrectomy, the adrenal gland does not have to be removed in every case. If the cancer is in the lower part of the kidney (away from the adrenal gland) and imaging tests show the adrenal gland is not affected, it may not have to be removed. Again, similar to lymph node removal, this is decided on an individual basis and should be discussed with the doctor before surgery.

Removal of metastases

About 1 in 4 patients with renal cell carcinoma will already have metastatic spread of their cancer when they are diagnosed. The lungs, bones, brain and liver are the most common sites of spread. In some patients, surgery may still be helpful.

Attempts at curative surgery: In rare cases where there is only a single metastasis or if there are only a few that can be removed easily without causing serious side effects, surgery may lead to long-term survival in some people. The metastasis may be removed at the same time as a radical nephrectomy or at a later time if the cancer recurs (comes back).

Surgery to relieve symptoms (palliative surgery): When other treatments aren't helpful, surgically removing the metastases can sometimes relieve pain and other symptoms, although this usually does not help patients live longer.

Also, removing the kidney containing the cancer can help patients live longer even when the cancer has already spread to distant sites. This is why a doctor may suggest a radical nephrectomy even if the patient's cancer has spread beyond the kidney. Kidney removal can also be used to ease symptoms such as pain and bleeding.

Risks of surgery

Risks of 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 near the surgical incision due to problems with wound healing)
- Kidney failure (if the remaining kidney fails to function well)

Ablation and other local therapy for kidney cancer

Whenever possible, surgery is the main treatment for kidney cancers that can be removed. But for people who are too sick to have surgery, other approaches can sometimes be used to destroy kidney tumors. They might be helpful for some people, but there is much less data on how well they work over the long run than there is for surgery, and so they are not yet considered a standard treatment.

Cryotherapy (cryoablation)

This approach uses extreme cold to destroy the tumor. A hollow probe (needle) is inserted into the tumor either through the skin (percutaneously) or during laparoscopy (laparoscopy was discussed in the "Surgery for kidney cancer" section). Very cold gases are passed through the probe, creating an ice ball that destroys the tumor. To be sure the tumor is destroyed without too much damage to nearby tissues, the doctor carefully watches images of the tumor during the procedure (with ultrasound) or measures tissue temperature.

The type of anesthesia used for cryotherapy depends on how the procedure is being done. Possible side effects include bleeding and damage to the kidneys or other nearby organs.

Radiofrequency ablation

This technique uses high-energy radio waves to heat the tumor. A thin, needle-like probe is placed through the skin and advanced until the end is in the tumor. Placement of the probe is guided by ultrasound or CT scans. Once it is in place, an electric current is passed through the probe, which heats the tumor and destroys the cancer cells.

Radiofrequency ablation is usually done as an outpatient procedure, using local anesthesia (numbing medicine) where the probe is inserted. You may be given medicine to help you relax as well. Major complications are uncommon, but they can include bleeding and damage to the kidneys or other nearby organs.

Arterial embolization

This technique is used to block the artery that feeds the kidney with the tumor. A small catheter (tube) is placed in an artery in the inner thigh and is moved up until it reaches the artery going from the aorta to the kidney (renal artery). Material is then injected into the artery to block it, cutting off the kidney's blood supply. This will cause the kidney (and the tumor in it) to die. Although this procedure is not used very often, it is sometimes done before nephrectomy to reduce bleeding during the operation or in patients who have persistent bleeding from the kidney tumor.

Active surveillance for kidney cancer

One option for some patients with small kidney tumors (those less than 3 cm, which is a little over an inch), may be to give no treatment at first and watch the tumor to see if it

grows. Several studies have looked at this. The tumors are watched carefully and if they grow fast or get larger than 4 cm − a little over 1 ½ inches − they are removed. This approach is most often used in elderly or frail patients as it avoids the risks of treatment. Up to 3 in 10 of these small tumors turn out to not be cancers at all. Watching them closely for a time helps doctors decide which tumors are more likely to be cancer based on their growth pattern. This approach can allow some patients to avoid surgery or other treatments. Often, a biopsy is done before deciding to watch the tumor to see if the growth is really cancer.

Radiation therapy for kidney cancer

Radiation therapy uses high-energy radiation to kill cancer cells. *External beam therapy* focuses radiation from outside the body on the cancer. It is like getting an x-ray, but the radiation is much more intense. The procedure itself is painless.

Kidney cancers are not very sensitive to radiation. Radiation therapy can be used to treat kidney cancer if a person's general health is too poor for them to have surgery. For patients who can have surgery, using radiation therapy before or after removing the cancer is not routinely recommended because studies have not shown that this helps people live longer.

Radiation therapy is more often used to *palliate*, or ease, symptoms of kidney cancer such as pain, bleeding, or problems caused by cancer spread (especially to the bones or brain).

A special type of radiation therapy known as *stereotactic radiosurgery* can sometimes be used for single tumors that have spread to the brain. This procedure does not actually involve surgery. There are 2 main techniques for stereotactic radiosurgery, but they all use the same principle of pinpoint radiation. In one technique, several beams of high-dose radiation are focused on the tumor from different angles over a few minutes to hours. The second technique uses a movable linear accelerator that is controlled by a computer (a linear accelerator is a machine that produces x-ray beams). Instead of delivering many beams at once, the linear accelerator moves around to deliver radiation to the tumor from different angles. In either approach, the patient's head is kept in the same position by placing it in a rigid frame. This type of treatment can also be used for areas of cancer spread outside of the brain. When it is used to treat cancer elsewhere, it is called *stereotactic body radiotherapy*.

Side effects of radiation therapy may include mild skin changes (similar to sunburn), hair loss, nausea, diarrhea, or tiredness. Often these go away after a short while. Radiation may also make side effects from some other treatments worse. Radiation therapy to the chest area can damage the lungs and lead to shortness of breath. Side effects of radiation to the brain usually become most serious 1 or 2 years after treatment and can include headaches and trouble thinking.

Chemotherapy for kidney cancer

Chemotherapy (chemo) uses anti-cancer drugs that are given into a vein or by mouth (in pill form). These drugs enter your 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 usually resistant to chemo, and so chemo is not a standard treatment for kidney cancer. Some chemo drugs, such as vinblastine, floxuridine, 5-fluorouracil (5-FU), capecitabine, and gemcitabine have been shown to help a small number of patients. Still, chemo is often only used for kidney cancer after targeted drugs and/or immunotherapy have already been tried.

Possible side effects of chemotherapy

Chemo drugs work by attacking cells that are dividing quickly, which is why they often work against cancer cells. But other cells in the body, such as those in the bone marrow, the lining of the mouth and intestines, and the hair follicles, also divide quickly. These cells are also likely to be affected by chemo, which can lead to certain side effects.

The side effects of chemo depend on the type of drugs, the amount taken, and the length of treatment. Possible side effects can include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Low blood counts

Chemo can affect the blood cell producing bone marrow, leading to low blood counts. This can cause:

- Increased chance of infections (due to low white blood cell counts)
- Easy bruising or bleeding (due to low blood platelet counts)
- Fatigue (due to low red blood cell counts)

These side effects usually go away after treatment is finished. There are often ways to prevent or lessen them. For example, drugs can be given to help prevent or reduce nausea and vomiting. Specific chemo drugs may each cause specific side effects. Ask your health care team about the side effects your chemo drugs may cause.

Targeted therapies for kidney cancer

As researchers have learned more about the molecular and genetic changes in cells that cause cancer, they have been able to develop newer drugs that specifically target some of these changes. These targeted drugs work differently from standard chemotherapy drugs and have different side effects. Targeted drugs are proving to be especially important in diseases such as kidney cancer, where chemotherapy has not been shown to be very effective.

The term targeted therapy may not be the most accurate way to describe these newer drugs, as even traditional chemotherapy targets certain cellular functions. However, this is the term commonly used for newer agents that have a more focused mechanism of action

Several targeted drugs have been approved by the US Food and Drug Administration for use against advanced kidney cancer. These include drugs that stop angiogenesis (growth of the new blood vessels that nourish cancers) and drugs that target other important cell growth factors. These drugs are often used as the first line of treatment against advanced kidney cancers. While they may shrink or slow the growth of the cancer, it doesn't seem that any of these drugs can actually cure kidney cancer.

Doctors are still learning the best ways to use these targeted drugs against advanced kidney cancers. As of now, they are most often used one at a time. If one doesn't work, another may be tried. It's not yet known if any one of these drugs is clearly better than the others, if combining them might be more helpful than giving them one at a time, or if one sequence is better than the other. Studies are being done to help answer these questions.

Sorafenib (Nexavar®)

This drug has been shown to slow the progression of the cancer in some patients with advanced disease. It acts by blocking both angiogenesis and growth-stimulating molecules in the cancer cell. Sorafenib does this by blocking several important cellular enzymes called *tyrosine kinases* that are important for cell growth and survival. It is taken as a pill. The most common side effects seen with this drug include fatigue, rash, diarrhea, increases in blood pressure, and redness, pain, swelling, or blisters on the palms of the hands or soles of the feet (hand-foot syndrome).

Sunitinib (Sutent®)

Sunitinib also blocks several tyrosine kinases, but not the same ones as sorafenib**.** This drug is a pill that has been shown to shrink or slow the progression of kidney cancer in many cases. It attacks both blood vessel growth and other targets that stimulate cancer cell growth. The most common side effects are nausea, diarrhea, changes in skin or hair color, mouth sores, weakness, and low white and red blood cell counts. Other possible effects include tiredness, high blood pressure, congestive heart failure, bleeding, hand-foot syndrome, and low thyroid hormone levels.

Temsirolimus (Torisel®)

Temsirolimus is given as an intravenous (IV) infusion. It works by blocking a cell protein known as *mTOR*, which normally promotes cell growth and division. This drug has been shown to be helpful against advanced kidney cancers that have a poorer prognosis because of certain factors. The most common side effects of this drug include skin rash, weakness, mouth sores, nausea, loss of appetite, fluid buildup in the face or legs, and increases in blood sugar and cholesterol levels. Rarely, more serious side effects have been reported.

Everolimus (Afinitor®)

This drug also blocks the mTOR protein. It is taken as a pill once a day. Everolimus is used to treat advanced kidney cancers after other drugs such as sorafenib or sunitinib have been tried. Common side effects of this drug include mouth sores, an increased risk of infections, nausea, loss of appetite, diarrhea, skin rash, feeling tired or weak, fluid buildup (usually in the legs), and increases in blood sugar and cholesterol levels. A less common but serious side effect is lung damage, which can cause shortness of breath or other problems.

Bevacizumab (Avastin®)

This is an IV drug that works by slowing the growth of new blood vessels. Recent studies have shown it may be helpful against kidney cancer, especially when used with interferon-alpha. Bevacizumab is usually tolerated well by patients, but it can cause serious side effects such as increases in blood pressure, bleeding or blood clotting problems, and wound healing problems.

Pazopanib (Votrient®)

Pazopanib is another drug that blocks several tyrosine kinases. These kinases are involved in cancer cell growth and the formation of new blood vessels. It is taken as a pill once a day. Common side effects include high blood pressure, nausea, diarrhea, headaches, low blood cell counts, and liver problems. In some patients this drug causes lab test results of liver function to become abnormal, but it also rarely leads to severe liver damage that can be life threatening. As with bevacizumab, problems with bleeding, clotting, and wound healing can occur, as well. It also rarely causes a problem with the heart rhythm or even a heart attack. If you are taking this drug, your doctor will monitor your heart with EKGs as well as check your blood tests to check for liver or other problems.

Axitinib (Inlyta®)

This drug also inhibits several tyrosine kinases, including some that are involved in the formation of new blood vessels. It is taken as a pill twice a day. Common side effects include high blood pressure, fatigue, nausea and vomiting, diarrhea, poor appetite and

weight loss, voice changes, hand-foot syndrome, and constipation. In studies, high blood pressure requiring treatment was fairly common, but in a few patients it got so high that it was life-threatening. As with bevacizumab, there may be problems with bleeding, clotting, and wound healing. In some patients, lab test results of liver function can become abnormal. Axitinib may also cause the thyroid gland to become underactive, so your doctor will watch your blood levels of thyroid hormone while you are on this drug.

Biologic therapy (immunotherapy) for kidney cancer

The goal of biologic therapy is to boost the body's immune system to fight off or destroy cancer cells more effectively. The main immunotherapy drugs used in kidney cancer are cytokines (proteins that activate the immune system). In the past, the cytokines used most often were interleukin-2 (IL-2) and interferon-alpha. Both cytokines cause these cancers to shrink to less than half their original size in about 10% to 20% of patients.

At one point, IL-2 was the most common first-line therapy for advanced kidney cancer, and it may still be helpful for some people. But because it can be hard to give and can cause serious side effects, many doctors now only use it for cancers that aren't responding to targeted therapies.

Patients who respond to IL-2 tend to have lasting responses. IL-2 is the only therapy that appears to result in long-lasting responses, although only a small percentage of patients respond. A cancer has certain characteristics that may help predict if IL-2 will be helpful, and more studies are being done to see which characteristics are most helpful.

Interferon has less serious side effects than IL-2, and may be used by itself or used at a lower dose combined with the targeted drug bevacizumab (Avastin). Common side effects of interferon include flu-like symptoms (fever, chills, muscle aches), fatigue, and nausea.

Combining low doses of both cytokines was once thought to be as effective as high-dose IL-2, with fewer and less severe side effects, but more recent studies have not supported this idea. Most doctors think that high-dose IL-2 has a better chance of shrinking the cancer. High dose IL-2 is only given in certain centers, because it can be very toxic and special care is needed to recognize and treat side effects.

The possible side effects of high-dose IL-2, include:

- Extreme fatigue
- Low blood pressure
- Fluid buildup in the lungs
- Trouble breathing
- Kidney damage
- Heart attacks

- Intestinal bleeding
- Diarrhea or abdominal pain
- High fever and chills
- Rapid heart beat
- Mental changes

These side effects are often severe and, rarely, can be fatal. For this reason, cytokine therapy is not used in people who are in poor overall health to begin with. Only doctors experienced in the use of these cytokines should give this treatment.

Cytokines can also be used as part of some experimental immunotherapy techniques. One approach took special immune system cells called *tumor-infiltrating lymphocytes* (TILs) that can be found within kidney tumors. These cells were taken from the tumor after surgery. These immune cells were then exposed to cytokines in the lab and then given back to the patient. The hope was that they would attack the cancer cells with fewer side effects than just giving cytokines, but the outcomes were disappointing.

Newer forms of immunotherapy are described in the section, “What's new in kidney cancer research and treatment?”

Pain control for kidney cancer

Pain is a concern for some patients with advanced kidney cancer. It is important to let your doctor know about any pain you might have so that it can be treated. Unless your doctor knows about your pain, they can't help you.

There are many different forms of pain medicine, ranging from over-the-counter pain relievers to stronger drugs like morphine or other opioids. For 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 have been developed that need only to be taken once or twice a day.

In some cases, palliative surgery or radiation therapy may help relieve pain caused by cancer spreading to certain areas. Drugs called *bisphosphonates* may be helpful in people whose cancers have spread to their bones. Sometimes pain specialists can do certain procedures such as a nerve block to lessen pain, depending on where the pain is.

Clinical trials for kidney cancer

You may have had to make a lot of decisions since you've been told you have cancer. One of the most important decisions you will make is choosing which treatment is best for you. You may have heard about clinical trials being done for your type of cancer. Or maybe someone on your health care team has mentioned a clinical trial to you.

Clinical trials are carefully controlled research studies that are done with patients who volunteer for them. They are done to get a closer look at promising new treatments or procedures.

If you would like to take part in a clinical trial, you should start by asking your doctor if your clinic or hospital conducts clinical trials. You can also call our clinical trials matching service for a list of clinical trials that meet your medical needs. You can reach this service at 1-800-303-5691 or on our Web site at www.cancer.org/clinicaltrials. 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 (1-800-422-6237) or by visiting the NCI clinical trials Web site at www.cancer.gov/clinicaltrials.

There are requirements you must meet to take part in any clinical trial. If you do qualify for a clinical trial, it is up to you whether or not to enter (enroll in) it.

Clinical trials are one way to get state-of-the art cancer treatment. They are the only way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

You can get a lot more information on clinical trials in our document called *Clinical Trials: What You Need to Know* You can read it on our Web site or call our toll-free number (1-800-227-2345) and have it sent to you.

Complementary and alternative therapies for kidney cancer

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that your doctor hasn't mentioned. Everyone from friends and family to Internet groups and Web sites may offer ideas for what might help you. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

What exactly are complementary and alternative therapies?

Not everyone uses these terms the same way, and they are used to refer to many different methods, so it can be confusing. We use *complementary* to refer to treatments that are used *along with* your regular medical care. *Alternative* treatments are used *instead of* a doctor's medical treatment.

Complementary methods: Most complementary treatment methods are not offered as cures for cancer. Mainly, they are used to help you feel better. Some methods that are used along with regular treatment are meditation to reduce stress, acupuncture to help relieve pain, or peppermint tea to relieve nausea. Some complementary methods are known to help, while others have not been tested. Some have been proven to not be helpful, and a few have even been found harmful.

Alternative treatments: Alternative treatments may be offered as cancer cures. These treatments have not been proven safe and effective in clinical trials. Some of these methods may pose danger, or have life-threatening side effects. But the biggest danger in most cases is that you may lose the chance to be helped by standard medical treatment.

Delays or interruptions in your medical treatments may give the cancer more time to grow and make it less likely that treatment will help.

Finding out more

It is easy to see why people with cancer think about alternative methods. You want to do all you can to fight the cancer, and the idea of a treatment with no side effects sounds great. Sometimes medical treatments like chemotherapy can be hard to take, or they may no longer be working. But the truth is that most of these alternative methods have not been tested and proven to work in treating cancer.

As you consider your options, here are 3 important steps you can take:

- Look for "red flags" that suggest fraud. Does the method promise to cure all or most cancers? Are you told not to have regular medical treatments? Is the treatment a "secret" that requires you to visit certain providers or travel to another country?
- Talk to your doctor or nurse about any method you are thinking about using.
- Contact us at 1-800-227-2345 to learn more about complementary and alternative methods in general and to find out about the specific methods you are looking at.

The choice is yours

Decisions about how to treat or manage your cancer are always yours to make. If you want to use a non-standard treatment, learn all you can about the method and talk to your doctor about it. With good information and the support of your health care team, you may be able to safely use the methods that can help you while avoiding those that could be harmful.

Treatment choices by stage for kidney cancer

The type of treatment(s) your doctor recommends will depend on the stage of the cancer and on your overall health. This section summarizes options usually considered for each stage of kidney cancer.

Stages I, II, or III

These cancers are usually removed with surgery when possible. Partial or radical nephrectomy may be done, with partial nephrectomy often the treatment of choice in tumors up to 7 cm (a little less than 3 inches in size). If the lymph nodes around the kidneys are enlarged, they may be removed as well. If the cancer has grown into nearby veins (as with some stage III cancers), the surgeon may need to cut open these veins to remove all of the cancer. This may require putting the patient on bypass (a heart-lung machine), so that the heart can be stopped for a short time to remove the cancer from the large vein leading to the heart.

Other than as part of a clinical trial, additional treatments (known as *adjuvant therapy*) are usually not given after surgery that has removed all of the cancer. So far, treatments such as targeted therapy, chemotherapy, radiation therapy, or immunotherapy have not been shown to help patients live longer if all of the cancer has been removed. There are, however, ongoing clinical trials that are looking at adjuvant treatment for kidney cancer. Ask your doctor for more information about adjuvant clinical trials.

If you cannot have kidney surgery because of other serious medical problems, you may benefit from other local treatments such as cryotherapy, radiofrequency ablation, radiation therapy, or arterial embolization. These treatments are generally only given when surgery can't be done. Although they haven't been directly compared to surgery in studies, most doctors consider these treatments to be less effective than surgery.

Active surveillance is another option for small tumors. For this, the tumor is watched (with CTs or ultrasounds) and only treated if it grows.

Stage IV

Stage IV kidney cancer means that the cancer has grown from the kidney to spread beyond Gerota's fascia (fibrous layer that surrounds the kidney and nearby fatty tissue) and it may have grown into the adrenal gland (on top of the kidney). It can also mean that the cancer has spread outside the kidney to other organs.

Treatment of stage IV kidney cancer depends on how extensive the cancer is and on the person's general health. In some cases, surgery may still be a part of treatment.

In rare cases where the main tumor appears to be removable and the cancer has only spread to one other area (such as to one or a few spots in the lungs), surgery to remove both the kidney and the metastasis may be an option if a person is in good enough health. Otherwise, treatment with one of the targeted therapies would probably be the first option.

If the main tumor is removable but the cancer has spread extensively elsewhere, removing the kidney may still be helpful. This would likely be followed by systemic therapy, which might consist of one of the targeted therapies or cytokine therapy (interleukin-2 or interferon). More often targeted therapy is used first. It's not clear if any one of the targeted therapies or any particular sequence is better than another, although temsirolimus appears to be most useful in people with kidney cancers that have a poorer prognosis (outlook).

For cancers that can't be removed surgically (because of the extent of the tumor or a person's health), first-line treatment is likely to be one of the targeted therapies or cytokine therapy.

Because advanced kidney cancer is very hard to cure, clinical trials of new combinations of targeted therapies, immunotherapy, or other new treatments are also options.

For some patients, palliative treatments such as embolization or radiation therapy may be the best option. A special form of radiation therapy called *stereotactic radiosurgery* can

be very effective in treating single brain metastases. Surgery or radiation therapy can also be used to help reduce pain or other symptoms of metastases in some other places, such as the bones.

Having your pain controlled can help you maintain your quality of life. It is important to realize that medicines to relieve pain do not interfere with your other treatments and that controlling pain will often help you be more active and continue your daily activities.

Recurrent cancer

Cancer is called *recurrent* when it come backs after treatment. Recurrence can be local (in or near the same place it started) or distant (spread to organs such as the lungs or bone). Treatment of kidney cancer that comes back (recurs) after initial treatment depends on where it recurs and what treatments have been used, as well as a person's health and wishes for further treatment.

For cancers that recur after initial surgery, further surgery might be an option. Otherwise, treatment with targeted therapies or immunotherapy will probably be recommended. Clinical trials of new treatments are an option as well.

For cancers that progress (continue to grow or spread) during treatment with targeted therapy or cytokine therapy, another type of targeted therapy may be helpful, at least for a time. If these don't work, chemotherapy may be tried, especially in people with non-clear cell types of kidney cancer. Clinical trials may be a good option in this situation for those who want to continue treatment.

Again, for some patients, palliative treatments such as embolization or radiation therapy may be the best option. Controlling symptoms such as pain is an important part of treatment at any stage of the disease.

More treatment information about kidney cancer

For more details on treatment options − including some that may not be addressed in this document − the National Comprehensive Cancer Network (NCCN) and the National Cancer Institute (NCI) are good sources of information.

The NCCN, made up of experts from many of the nation's leading cancer centers, develops cancer treatment guidelines for doctors to use when treating patients. These are available on the NCCN Web site (www.nccn.org).

The NCI provides treatment guidelines via its telephone information center (1-800-4-CANCER) and its Web site (www.cancer.gov). Detailed guidelines intended for use by cancer care professionals are also available on www.cancer.gov.

What should you ask your doctor about kidney cancer?

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 asking these questions:

- What kind of kidney cancer do I have?
- Do you think my cancer has spread?
- What is the stage of my cancer and what does that mean?
- 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 (outcome)?
- 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?
- What type of follow-up will I need after treatment?
- Are there any clinical trials I should think about?

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

What happens after treatment for kidney cancer?

For some people with kidney cancer, treatment may remove or destroy the cancer. Completing treatment can be both stressful and exciting. You may be relieved to finish treatment, but find it hard not to worry about cancer coming back. (When cancer comes back after treatment, it is called *recurrence*.) This is a very common concern in people who have had cancer.

It may take a while before your fears lessen. But it may help to know that many cancer survivors have learned to live with this uncertainty and are leading full lives. Our

document, *Living With Uncertainty: The Fear of Cancer Recurrence*, gives more detailed information on this.

For other people, the cancer may never go away completely. These people may get regular treatments with chemotherapy, radiation therapy, or other therapies to try to help keep the cancer in check. Learning to live with cancer that does not go away can be difficult and very stressful. It has its own type of uncertainty. Our document, *When Cancer Doesn't Go Away*, talks more about this.

Follow-up care

When treatment ends, your doctors will still want to watch you closely. It is very important to go to all of your follow-up appointments. During these visits, your doctors will ask questions about any problems you may have and may do exams and lab tests or x-rays and scans to look for signs of cancer or treatment side effects. Almost any cancer treatment can have side effects. Some can last for a few weeks to months, but others can last the rest of your life. This is the time for you to talk to your cancer care team about any changes or problems you notice and any questions or concerns you have

For people whose kidney cancer has been removed by surgery, doctor visits (which include physical exams and blood tests) are usually recommended about every 6 months for the first 2 years after treatment, then yearly for the next several years. A CT scan is usually recommended about 4 to 6 months after surgery and may be repeated later if there's reason to suspect the cancer may have returned. (Treatment of recurrent cancer is described in the section, "Treatment choices by stage for kidney cancer.") Patients who have a higher risk of their cancers coming back after surgery, such as cancer that had spread to lymph nodes, may be seen more often with CT scans repeated at least every 6 months for the first few years.

Each type of treatment for kidney cancer has side effects that may last for a few months. You may be able to hasten your recovery by being aware of the side effects before you start treatment. You might be able to take steps to reduce them and shorten the length of time they last. Don't hesitate to tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them.

It is important to keep your health insurance. Tests and doctor visits cost a lot, and even though no one wants to think of their cancer coming back, this could happen.

Should your cancer come back, our document, *When Your Cancer Comes Back: Cancer Recurrence,* can give you information on how to manage and cope with this phase of your treatment.

Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself seeing a new doctor who does not know anything about your medical history. It is important that you be able to give your new doctor the details of your diagnosis and treatment. Make sure you have this information handy:

- A copy of your pathology report(s) from any biopsies or surgeries
- If you had surgery, a copy of your operative report
- If you had radiation, a copy of your treatment summary
- If you were hospitalized, a copy of the discharge summary that doctor prepare when patients are sent home from the hospital
- If you had chemotherapy (including biologic therapy or targeted therapy), a list of the drugs, drug doses, and when you took them
- Copies of your CTs, MRIs, or other imaging tests (these can often be placed on a DVD)

The doctor may want copies of this information for his records, but always keep copies for yourself.

Lifestyle changes after treatment for kidney cancer

You can't change the fact that you have had cancer. What you can change is how you live the rest of your life – making choices to help you stay healthy and feel as well as you can. This can be a time to look at your life in new ways. Maybe you are thinking about how to improve your health over the long term. Some people even start during cancer treatment.

Making healthier choices

For many people, a diagnosis of cancer helps them focus on their health in ways they may not have thought much about in the past. Are there things you could do that might make you healthier? Maybe you could try to eat better or get more exercise. Maybe you could cut down on the alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you are thinking about quitting smoking and need help, call the American Cancer Society for information and support. This tobacco cessation and coaching service can help increase your chances of quitting for good.

Eating better

Eating right can be hard for anyone, but it can get even tougher during and after cancer treatment. Treatment may change your sense of taste. Nausea can be a problem. You may not feel like eating and lose weight when you don't want to. Or you may have gained weight that you can't seem to lose. All of these things can be very frustrating.

If treatment caused weight changes or eating or taste problems, do the best you can and keep in mind that these problems usually get better over time. You may find it helps to eat small portions every 2 to 3 hours until you feel better. You may also want to ask your cancer team about seeing a dietitian, an expert in nutrition who can give you ideas on how to deal with these treatment side effects.

One of the best things you can do after cancer treatment is put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Getting to and staying at a healthy weight, eating a healthy diet, and limiting your alcohol intake may lower your risk for a number of types of cancer, as well as having many other health benefits.

Rest, fatigue, and exercise

Extreme tiredness, called *fatigue*, is very common in people treated for cancer. This is not a normal tiredness, but a "bone-weary" exhaustion that doesn't get better with rest. For some people, fatigue lasts a long time after treatment, and can make it hard for them to exercise and do other things they want to do. But exercise can help reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel better physically and emotionally and can cope better, too.

If you were sick and not very active during treatment, it is normal for your fitness, endurance, and muscle strength to decline. Any plan for physical activity should fit your own situation. An older person who has never exercised will not be able to take on the same amount of exercise as a 20-year-old who plays tennis twice a week. If you haven't exercised in a few years, you will have to start slowly – maybe just by taking short walks.

Talk with your health care team before starting anything. Get their opinion about your exercise plans. Then, try to find an exercise buddy so you're not doing it alone. Having family or friends involved when starting a new exercise program can give you that extra boost of support to keep you going when the push just isn't there.

If you are very tired, you will need to balance activity with rest. It is OK to rest when you need to. Sometimes it's really hard for people to allow themselves to rest when they are used to working all day or taking care of a household, but this is not the time to push yourself too hard. Listen to your body and rest when you need to. (For more information on dealing with fatigue, please see *Fatigue in People With Cancer* and *Anemia in People With Cancer*.)

Keep in mind exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- Along with a good diet, it will help you get to and stay at a healthy weight.
- It makes your muscles stronger.
- It reduces fatigue and helps you have more energy.
- It can help lower anxiety and depression.

- It can make you feel happier.
- It helps you feel better about yourself.

And long term, we know that getting regular physical activity plays a role in helping to lower the risk of some cancers, as well as having other health benefits.

How does having kidney cancer affect your emotional health?

When treatment ends, you may find yourself overcome with many different emotions. This happens to a lot of people. You may have been going through so much during treatment that you could only focus on getting through each day. Now it may feel like a lot of other issues are catching up with you.

You may find yourself thinking about death and dying. Or maybe you're more aware of the effect the cancer has on your family, friends, and career. You may take a new look at your relationship with those around you. Unexpected issues may also cause concern. For instance, as you feel better and have fewer doctor visits, you will see your health care team less often and have more time on your hands. These changes can make some people anxious.

Almost everyone who has been through cancer can benefit from getting some type of support. You need people you can turn to for strength and comfort. Support can come in many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or one-on-one counselors. What's best for you depends on your situation and personality. Some people feel safe in peer-support groups or education groups. Others would rather talk in an informal setting, such as church. Others may feel more at ease talking one-on-one with a trusted friend or counselor. Whatever your source of strength or comfort, make sure you have a place to go with your concerns.

The cancer journey can feel very lonely. It is not necessary or good for you to try to deal with everything on your own. And your friends and family may feel shut out if you do not include them. Let them in, and let in anyone else who you feel may help. If you aren’t sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with a group or resource that may work for you.

If treatment for kidney cancer stops working

If cancer keeps growing or comes back after one kind of treatment, it is possible that another treatment plan might still cure the cancer, or at least shrink it enough to help you live longer and feel better. But when a person has tried many different treatments and the cancer has not gotten any better, the cancer tends to become resistant to all treatment. If this happens, it's important to weigh the possible limited benefits of a new treatment against the possible downsides. Everyone has their own way of looking at this.

This is likely to be the hardest part of your battle with cancer − when you have been through many medical treatments and nothing's working anymore. Your doctor may offer you new options, but at some point you may need to consider that treatment is not likely to improve your health or change your outcome or survival.

If you want to continue to get treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can estimate how likely it is the cancer will respond to treatment you are considering. For instance, the doctor may say that more chemo or radiation might have about a 1% chance of working. Some people are still tempted to try this. But it is important to think about and understand your reasons for choosing this plan.

No matter what you decide to do, you need to feel as good as you can. Make sure you are asking for and getting treatment for any symptoms you might have, such as nausea or pain. This type of treatment is called *palliative care*.

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose - the main purpose of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using drugs to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer.

At some point, you may benefit from hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time, it is given at home. Your cancer may be causing problems that need to be managed, and hospice focuses on your comfort. You should know that while getting hospice care often means the end of treatments such as chemo and radiation, it doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. In hospice the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult time. You can learn more about hospice in our document called *Hospice Care*.

Staying hopeful is important, too. Your hope for a cure may not be as bright, but there is still hope for good times with family and friends − times that are filled with happiness and meaning. Pausing at this time in your cancer treatment gives you a chance to refocus on the most important things in your life. Now is the time to do some things you've always wanted to do and to stop doing the things you no longer want to do. Though the cancer may be beyond your control, there are still choices you can make.

What's new in kidney cancer research and treatment?

There is always research going on in the area of kidney cancer. Scientists are looking for causes of 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. In addition to finding new medicines and looking at the best way to combine and sequence existing ones, a major area of research lies in finding better ways to select therapy for an individual. That is, finding factors about a person's cancer that make it more likely to respond to a certain medicine. This is a major area of research in many cancers, as doctors want to be able to individualize therapy as much as possible to increase a person's chance of benefiting from a therapy.

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.

For example, problems with the von Hippel-Lindau tumor suppressor gene are found in most clear cell kidney cancers. This allows other genes such as the hypoxia-inducible factor (*HIF*) gene to be activated when they shouldn't be, which drives a cell toward being cancerous. Newer treatments focus on attacking this cellular pathway.

Researchers now also have a better idea of the gene changes responsible for some other forms of kidney cancer. Doctors are now trying to determine which treatments are most likely to be effective for certain types of kidney cancer. This information can also be used to develop new treatments.

New approaches to local treatment

High-intensity focused ultrasound is a fairly new technique that is now being studied for use in kidney cancer. It involves pointing very focused ultrasound beams from outside the body to destroy the tumor.

Ablation with cryotherapy or radiofrequency ablation is sometimes used to treat small kidney cancers. Research is now under way to determine how useful these techniques are in the long term and to refine them further.

Targeted therapies

Because chemotherapy drugs have not been very effective against advanced kidney cancer, targeted therapies are now usually the first-line option to treat kidney cancers that cannot be removed by surgery. At this time they are usually given separately. Clinical trials are now under way to try to determine if combining these drugs, either with each other or with other types of treatment, might be better than using them alone. Several new targeted therapies are now being tested as well, with cediranib and linifanib showing promise.

The potential roles of giving these drugs before and after surgery (called neoadjuvant and adjuvant therapy, respectively) are also being studied.

Immunotherapy

Kidney cancer is one of a handful of cancers that may respond to immunotherapy. Clinical trials of new immunotherapy methods are being tested. Basic research is now being directed toward a better understanding of the immune system, how to activate it, and how it reacts to cancer.

Researchers are studying the use of cytokines to stimulate immune system cells that have been removed from circulating blood. The cells are treated with cytokines and exposed to killed tumor cells to make cells called *dendritic cells*. These cells are injected into lymph nodes in the hope that this will stimulate the immune system to fight the cancer. Early results have been promising, but more studies are needed.

Vaccines

Several types of vaccines for boosting the body's immune response to kidney cancer cells are being tested in clinical trials. Unlike vaccines against infections like measles or mumps, these vaccines are designed to help treat, not prevent, kidney cancer. One possible advantage of these types of treatments is that they seem to have very limited side effects.

There are several ways to create vaccines that might stimulate the immune system. In one approach, cancer cells (removed during surgery) are altered in the lab to make them more likely to cause an immune response and are then returned to the body. In another approach, a special virus is altered so it is no longer infectious, but it carries a gene for a protein often found on cancer cells. Once the virus is injected into the body, the hope is that the protein will cause the immune system to react against cancer cells anywhere in the body. Combining vaccines with targeted agents or other agents to help them work better is also being studied.

At this time, these vaccines are only available in clinical trials.

Bone marrow or peripheral blood stem cell transplant

In people with advanced kidney cancer, the person's own immune system is not effectively controlling the cancer. Another approach to immunotherapy is to try to use someone else's immune system to attack the cancer cells.

First, very primitive immune system cells (called *stem cells*) are collected from a compatible donor, either from their bone marrow or their blood. The person with cancer is then treated with chemotherapy drugs, either in lower doses (called a *mini* or *non-myeloablative stem cell transplant*) to suppress the immune system or in higher doses to cause more severe damage to the immune cells and other components of the bone marrow. They are then given the stem cells to try to build a new immune system that will be more likely to attack the cancer cells.

Some early studies of this technique have been promising, finding that it may help shrink kidney cancers in some people. But it can also cause major complications, and side effects can be severe. Until more is known about its safety and usefulness, it will probably only be available in clinical trials.

Additional resources for kidney cancer

More information from your American Cancer Society

Here is more information you might find helpful. You also can order free copies of our documents from our toll-free number, 1-800-227-2345, or read them on our Web site, www.cancer.org.

After Diagnosis: A Guide for Patients and Families (also available in Spanish)

Caring for the Person With Cancer at Home: A Guide for Patients and Families (also available in Spanish)

Clinical Trials: What You Need to Know

Immunotherapy

Living With Uncertainty: The Fear of Cancer Recurrence

Pain Control: A Guide for Those With Cancer and Their Loved Ones (also available in Spanish)

Targeted Therapy

Understanding Radiation Therapy: A Guide for Patients and Families (also available in Spanish)

When Cancer Doesn’t Go Away

When Your Cancer Comes Back: Cancer Recurrence

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online at cancer.org/bookstore to find out about costs or to place an order.

National organizations and Web sites*

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

American Urological Association
Toll-free number: 1-866-828-7866
Web site: www.auanet.org

Kidney Cancer Association
For toll-free number, click phone icon at:
www.kidneycancer.org/about-us/contact-us
Web site: www.kidneycancer.org

National Cancer Institute
Toll-free number: 1-800-4-CANCER (1-800-422-6237) TTY: 1-800-332-8615
Web site: www.cancer.gov

National Kidney Foundation
Toll-free number: 1-800622-9010
Web site: www.www.kidney.org

VHL (Von Hippel-Lindau) Family Alliance
Toll-free number: 1-800-767-4845
Telephone number: 1-617-277-5667
Web site: www.vhl.org

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

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at 1-800-227-2345 or visit www.cancer.org.

References: Kidney cancer detailed guide

Abreu SC, Finelli A, Gill IS. Management of localized renal cell carcinoma: minimally invasive nephron-sparing treatment options. In: Vogelzang NJ, Scardino PT, Shipley WU, Debruyne FMJ, Linehan WM, eds. *Comprehensive Textbook of Genitourinary Oncology*. 3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2006:755-765.

American Cancer Society. *Cancer Facts and Figures 2013*. Atlanta, Ga: American Cancer Society; 2013.

American Joint Committee on Cancer. *AJCC Cancer Staging Manual*. 7th ed. New York, NY. Springer; 2010:479-486.

Belldegrun AS, Klatte T, Shuch B, et al. Cancer-specific survival outcomes among patients treated during the cytokine era of kidney cancer (1989-2005): a benchmark for emerging targeted cancer therapies. *Cancer*. 2008 Nov 1;113(9):2457-2463.

Choyke PL. Radiologic imaging of renal cell carcinoma: its role in diagnosis. In: Vogelzang NJ, Scardino PT, Shipley WU, Debruyne FMJ, Linehan WM, eds. *Comprehensive Textbook of Genitourinary Oncology*. 3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2006:709-723.

Clague J, Lin J, Cassidy A, et al. Family history and risk of renal cell carcinoma: results from a case-control study and systematic meta-analysis. *Cancer Epidemiol Biomarkers Prev*. 2009 Mar;18(3):801-7.

Hawkins RE, Macdermott C, Shablak A, et al. Vaccination of patients with metastatic renal cancer with modified vaccinia Ankara encoding the tumor antigen 5T4 (TroVax) given alongside interferon-alpha. *J Immunother*. 2009 May;32(4):424-9.

Howlader N, Noone AM, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2009 (Vintage 2009 Populations), National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2009_pops09/, based on November 2011 SEER data submission, posted to the SEER web site, April 2012.

Hudes G, Carducci M, Tomczak P, et al. Temsirolimus, interferon alfa, or both for advanced renal-cell carcinoma. *N Engl J Med*. 2007;356:2271-2281.

Linehan WM, Schmidt LS. Molecular biology of kidney cancer. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 9th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2011:1154-1160.

Linehan WM, Rini BI, Yang JC. Cancer of the kidney. In: DeVita VT, Hellman S, Rosenberg SA, eds. *Cancer: Principles and Practice of Oncology*. 9th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2011:1161-1182.

McDermott DF, Regan MM, Clark JI, et al. Randomized phase III trial of high dose interleukin-2 versus subcutaneous interleukin-2 and interferon in patients with metastatic renal cell carcinoma. *J Clin Oncol*. 2005;23:133-141.

Mulders P, Hawkins R, Nathan P, et al. Cediranib monotherapy in patients with advanced renal cell carcinoma: results of a randomised phase II study. *Eur J Cancer*. 2012 Mar;48(4):527-37. Epub 2012 Jan 28.

National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: *Kidney Cancer*. V.2.2012. Accessed at: www.nccn.org on June 5, 2012.

Prenen H, Gil T, Awada A. New therapeutic developments in renal cell cancer. *Critical Rev Oncol Hematol.* 2009;69(1):56-63.

Pili R, Rodriguez R. Cancer of the kidney. In: Abeloff MD, Armitage JO, Lichter AS, Niederhuber JE. Kastan MB, McKenna WG, eds. *Clinical Oncology*. 4th ed. Philadelphia, Pa. Elsevier: 2008:1613-1634.

Rini BI, Escudier B, Tomczak P, et al. Comparative effectiveness of axitinib versus sorafenib in advanced renal cell carcinoma (AXIS): a randomised phase 3 trial. *Lancet*. 2011 Dec 3;378(9807):1931-9. Epub 2011 Nov 4.

Rini BI, Wilding G, Hudes G, et al. Phase II study of axitinib in sorafenib-refractory metastatic renal cell carcinoma. *J Clin Oncol*. 2009 Sep 20;27(27):4462-8. Epub 2009 Aug 3.

Schwaab T, Schwarzer A, Wolf B, et al. Clinical and immunologic effects of intranodal autologous tumor lysate-dendritic cell vaccine with Aldesleukin (Interleukin 2) and IFN-{alpha}2a therapy in metastatic renal cell carcinoma patients. *Clin Cancer Res*. 2009 Aug 1;15(15):4986-92.

Tannir NM, Wong YN, Kollmannsberger CK, et al. Phase 2 trial of linifanib (ABT-869) in patients with advanced renal cell cancer after sunitinib failure. *Eur J Cancer*. 2011 Dec;47(18):2706-14. Epub 2011 Nov 10.

Zisman A, Pantuck A, Wieder J, et al. Risk group assessment and clinical outcome algorithm to predict the natural history of patients with surgically resected renal cell carcinoma. *J Clin Oncol*. 2002;20:4559-4566.

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