



Liver Cancer

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 way. During the early years of a person's life, normal cells divide faster to allow the person to grow. Once 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 abnormal 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 through the bloodstream or lymph vessels, and begin to grow and form new tumors. This process is called *metastasis*.

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 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.

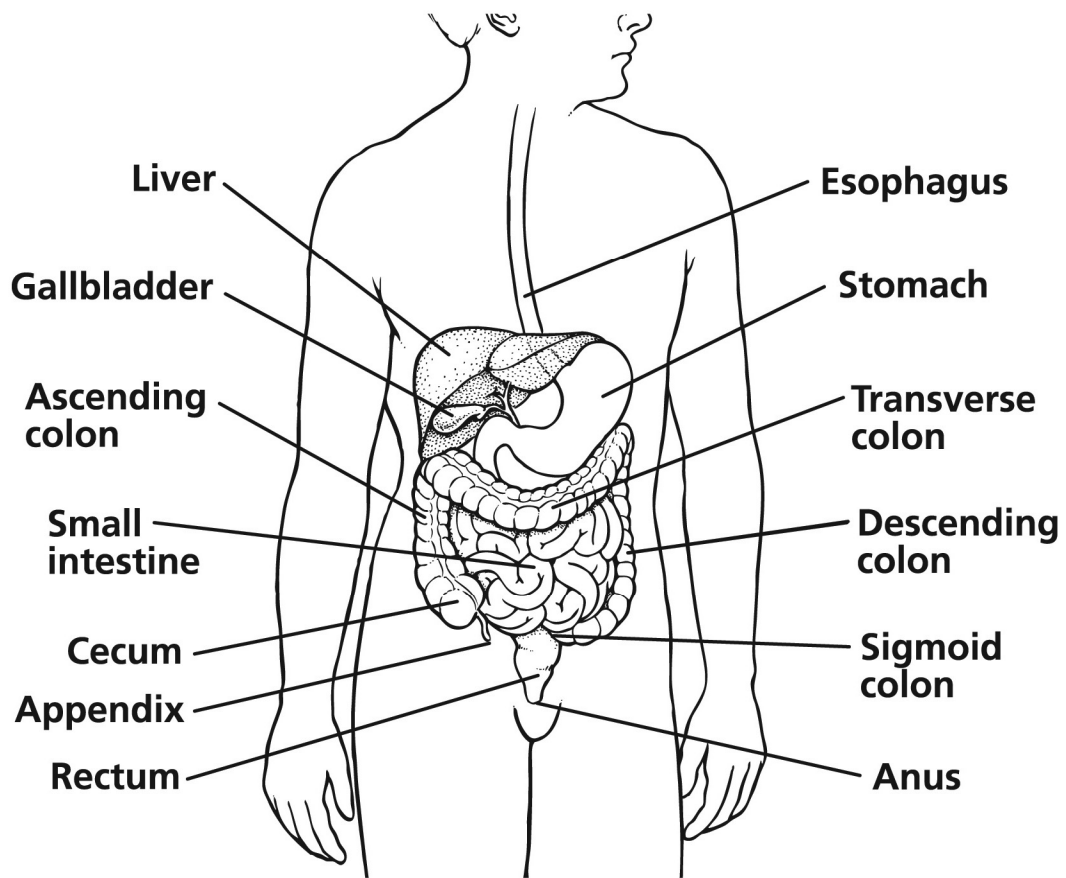
What is liver cancer?

Only cancers that start in the liver are called liver cancer. To understand liver cancer, it helps to know about the normal structure and function of the liver.

About the liver

The liver is the largest internal organ. It lies under your right ribs just beneath your right lung. It is shaped like a pyramid and divided into right and left lobes. The lobes are further

divided into segments.



Unlike most other organs, the liver gets blood from 2 sources: the *hepatic artery* supplies the liver with blood rich in oxygen from the heart, and the *portal vein* brings nutrient-rich blood from the intestines.

You cannot live without your liver. It has several important functions:

- It breaks down and stores many of the nutrients absorbed from the intestine that your body needs to function. Some nutrients must be changed (metabolized) in the liver before they can be used by the rest of the body for energy or to build and repair body tissues.
- It makes most of the clotting factors that keep you from bleeding too much when you are cut or injured.
- It secretes bile into the intestines to help absorb nutrients (especially fats).

- It filters out and breaks down toxic wastes in the blood, which are then removed from the body.

The liver is made up mainly of cells called *hepatocytes*. It also is made up of other types of cells, including cells that line its blood vessels and cells that line small tubes in the liver called *bile ducts*. The bile ducts extend out of the liver and carry bile from the liver to the gallbladder or directly to the intestines.

These different types of cells in the liver can form several types of malignant (cancerous) and benign (non-cancerous) tumors. These tumors have different causes, are treated differently, and have a different prognosis (outlook).

Benign liver tumors

Benign tumors sometimes grow large enough to cause problems, but they do not grow into nearby tissues or spread to distant parts of the body. If they need to be treated, the patient can usually be cured with surgery.

Hemangioma

The most common type of benign liver tumor, hemangiomas, start in blood vessels. Most hemangiomas of the liver cause no symptoms and do not need treatment. But some may bleed and need to be removed surgically.

Hepatic adenoma

Hepatic adenoma is a benign tumor that starts from hepatocytes (the main type of liver cell). Most cause no symptoms and do not need treatment. But some eventually cause symptoms, such as pain or a mass in the abdomen (stomach area) or blood loss. Because there is a risk that the tumor could rupture (leading to severe blood loss) and a small risk that it could eventually develop into liver cancer, most experts will usually advise surgery to remove the tumor if possible.

Using certain drugs may increase the risk of getting these tumors. Women have a higher chance of having one of these tumors if they take birth control pills, although this is rare. Men who use anabolic steroids may also develop these tumors. Adenomas may shrink when the drugs are stopped.

Focal nodular hyperplasia

Focal nodular hyperplasia (FNH) is a tumor-like growth made up of several cell types (hepatocytes, bile duct cells, and connective tissue cells). Although FNH tumors are benign, it can be hard to tell them apart from true liver cancers, and doctors sometimes remove them

when the diagnosis is unclear. If you have symptoms from an FNH tumor, it can be removed with surgery.

Both hepatic adenomas and FNH tumors are more common in women than in men.

Types of primary liver cancer

A cancer that starts in the liver is called *primary* liver cancer. There is more than one kind of primary liver cancer.

Hepatocellular carcinoma (hepatocellular cancer)

This is the most common form of liver cancer in adults. It is also sometimes called *hepatoma*. About 4 of 5 cancers that start in the liver are this type.

Hepatocellular cancer (HCC) can have different growth patterns:

- Some begin as a single tumor that grows larger. Only late in the disease does it spread to other parts of the liver.
- A second type seems to start as many small cancer nodules throughout the liver, not just a single tumor. This is seen most often in people with cirrhosis (chronic liver damage) and is the most common pattern seen in the United States.

Under a microscope, doctors can distinguish several subtypes of HCC. Most often these subtypes do not affect treatment or prognosis (outlook). But one of these subtypes, *fibrolamellar*, is important to recognize. This type is rare, making up less than 1% of HCCs. This type is most often seen in women younger than age 35, and often the rest of the liver is not diseased. This subtype generally has a better outlook than other forms of HCC.

In this document, the term “liver cancer” is used to mean hepatocellular carcinoma.

Intrahepatic cholangiocarcinoma (bile duct cancer)

About 10% to 20% of cancers that start in the liver are intrahepatic cholangiocarcinomas. These cancers start in the cells that line the small bile ducts (tubes that carry bile to the gallbladder) within the liver. (Most cholangiocarcinomas actually start in the bile ducts outside the liver.)

Although the rest of this document deals mainly with hepatocellular cancers, cholangiocarcinomas are often treated the same way. For more detailed information on this type of cancer, see our document, *Bile Duct (Cholangiocarcinoma) Cancer*.

Angiosarcoma and hemangiosarcoma

These are rare cancers that begin in cells lining the blood vessels of the liver. People who have been exposed to vinyl chloride or to thorium dioxide (Thorotrast) are more likely to develop these cancers. See the section "What are the risk factors for liver cancer?" Some other cases are thought to be caused by exposure to arsenic or radium, or to an inherited condition known as *hereditary hemochromatosis*. In about half of all cases, no likely cause can be identified.

These tumors grow quickly and are usually too widespread to be removed surgically by the time they are found. Chemotherapy and radiation therapy may help slow the disease, but these cancers are usually very hard to treat. These cancers are treated like other sarcomas. For more information, see our document *Sarcoma – Adult Soft Tissue Cancer*.

Hepatoblastoma

This is a very rare kind of cancer that develops in children, usually in those younger than 4 years old. The cells of hepatoblastoma are similar to fetal liver cells. About 2 out of 3 children with these tumors are treated successfully with surgery and chemotherapy, although the tumors are harder to treat if they have spread outside the liver.

Secondary liver cancer

Most of the time when cancer is found in the liver it did not start there but has spread (metastasized) from somewhere else in the body, such as the pancreas, colon, stomach, breast, or lung. Because this cancer has spread from its original (primary) site, it is a secondary liver cancer. These tumors are named and treated based on their primary site (where they started). For example, cancer that started in the lung and spread to the liver is called *lung cancer with spread to the liver*, not liver cancer, and it is treated as lung cancer.

In the United States and Europe, secondary (metastatic) liver tumors are more common than primary liver cancer. The opposite is true for many areas of Asia and Africa.

For more information on liver metastases from different types of cancer, see our documents on specific cancer types, as well as our document, *Advanced Cancer*.

Most of the remaining content in this document refers only to hepatocellular carcinoma.

What are the key statistics about liver cancer?

The American Cancer Society's estimates for primary liver cancer and intrahepatic bile duct cancer in the United States for 2015 are:

- About 35,660 new cases (25,510 in men and 10,150 in women) will be diagnosed

- About 24,550 people (17,030 men and 7,520 women) will die of these cancers

The percentage of Americans developing liver cancer has been rising slowly for several decades.

Liver cancer is seen more often in men than in women. An average man's lifetime risk of getting liver or intrahepatic bile duct cancer is about 1 in 81, while an average woman's risk is about 1 in 196. Most cases occur in people with certain risk factors (see the section "What are the risk factors for liver cancer?").

The average age at diagnosis of liver cancer is 63. More than 95% of people diagnosed with liver cancer are 45 years of age or older. About 3% are between 35 and 44 years of age and about 2% are younger than 35.

Liver cancer is much more common in countries in sub-Saharan Africa and Southeast Asia than in the US. In many of these countries it is the most common type of cancer. More than 700,000 people are diagnosed with this cancer each year throughout the world. Liver cancer is also a leading cause of cancer deaths worldwide, accounting for more than 600,000 deaths each year.

What are the risk factors for liver cancer?

A risk factor is anything that affects your chance of getting a disease, such as cancer. Different cancers have different risk factors. Some risk factors, like smoking, can be changed. Others, like a person's age or family history, can't be changed.

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 have few or no known risk factors.

Scientists have found several risk factors that make a person more likely to develop hepatocellular carcinoma (HCC).

Gender

Hepatocellular carcinoma is much more common in males than in females. Much of this is probably because of behaviors affecting some of the risk factors described below. The fibrolamellar subtype of HCC is more common in women.

Race/ethnicity

In the United States, Asian Americans and Pacific Islanders have the highest rates of liver cancer, followed by American Indians/Alaska Natives and Hispanics/Latinos, African Americans, and whites.

Chronic viral hepatitis

Worldwide, the most common risk factor for liver cancer is chronic (long-term) infection with hepatitis B virus (HBV) or hepatitis C virus (HCV). These infections lead to cirrhosis of the liver (see above) and are responsible for making liver cancer the most common cancer in many parts of the world.

In the United States, infection with hepatitis C is the more common cause of HCC, while in Asia and developing countries, hepatitis B is more common. People infected with both viruses have a high risk of developing chronic hepatitis, cirrhosis, and liver cancer. The risk is even higher if they are heavy drinkers (at least 6 standard drinks a day).

HBV and HCV can spread from person to person through sharing contaminated needles (such as in drug use), unprotected sex, or childbirth. They can also be passed on through blood transfusions, although this is very rare in the United States since the start of blood product testing for these viruses. In developing countries, children sometimes contract hepatitis B infection from prolonged contact with family members who are infected.

HBV is more likely to cause symptoms, such as a flu-like illness and a yellowing of the eyes and skin (jaundice). But most people recover completely from HBV infection within a few months. Only a very small percentage of adults become chronic carriers (and have a higher risk for liver cancer). Infants and small children who become infected have a higher risk of becoming chronic carriers.

HCV, on the other hand, is less likely to cause symptoms. But most people with HCV develop chronic infections, which are more likely to lead to liver damage or even cancer.

Other viruses, such as the hepatitis A virus and hepatitis E virus, can also cause hepatitis. But people infected with these viruses do not develop chronic hepatitis or cirrhosis, and do not have an increased risk of liver cancer.

Cirrhosis

Cirrhosis is a disease in which liver cells become damaged and are replaced by scar tissue. People with cirrhosis have an increased risk of liver cancer. Most (but not all) people who develop liver cancer already have some evidence of cirrhosis.

There are several possible causes of cirrhosis. Most cases in the United States occur in people who abuse alcohol or have chronic HBV or HCV infections.

Non-alcoholic fatty liver disease, a condition in which people who consume little or no alcohol develop a fatty liver, is common in obese people. People with a type of this disease known as *non-alcoholic steatohepatitis* (NASH) might go on to develop cirrhosis.

Some types of autoimmune diseases that affect the liver can also cause cirrhosis. For example, there is also a disease called *primary biliary cirrhosis* (PBC). PBC seems to be an

autoimmune condition, in which the immune system attacks the bile ducts in the liver. This causes the bile ducts to become damaged and even destroyed and can lead to cirrhosis. People with advanced PBC have a high risk of liver cancer.

Certain types of inherited metabolic diseases (see below) can cause problems in the liver that lead to cirrhosis.

Heavy alcohol use

Alcohol abuse is a leading cause of cirrhosis in the United States, which in turn is linked with an increased risk of liver cancer.

Obesity

Being obese (very overweight) increases the risk of developing liver cancer. This is probably because it can result in fatty liver disease and cirrhosis.

Type 2 diabetes

Type 2 diabetes has been linked with an increased risk of liver cancer, usually in patients who also have other risk factors such as heavy alcohol use and/or chronic viral hepatitis. This risk may be increased because people with type 2 diabetes tend to be overweight or obese, which in turn can cause liver problems.

Inherited metabolic diseases

Certain inherited metabolic diseases can lead to cirrhosis.

People with *hereditary hemochromatosis* absorb too much iron from their food. The iron settles in tissues throughout the body, including the liver. If enough iron builds up in the liver, it can lead to cirrhosis and liver cancer.

Other rare diseases that increase the risk of liver cancer include:

- Tyrosinemia
- Alpha1-antitrypsin deficiency
- Porphyria cutanea tarda
- Glycogen storage diseases
- Wilson disease

Aflatoxins

These cancer-causing substances are made by a fungus that contaminates peanuts, wheat, soybeans, ground nuts, corn, and rice. Storage in a moist, warm environment can lead to the growth of this fungus. Although this can occur almost anywhere in the world, it is more common in warmer and tropical countries. Developed countries such as the United States and those in Europe regulate the content of aflatoxins in foods through testing.

Long-term exposure to these substances is a major risk factor for liver cancer. The risk is increased even more in people with hepatitis B or C infections.

Vinyl chloride and thorium dioxide (Thorotrast)

Exposure to these chemicals raises the risk of angiosarcoma of the liver (see the section, “What is liver cancer?”). It also increases the risk of developing cholangiocarcinoma and hepatocellular cancer, but to a far lesser degree. Vinyl chloride is a chemical used in making some kinds of plastics. Thorotrast is a chemical that in the past was injected into some patients as part of certain x-ray tests. When the cancer-causing properties of these chemicals were recognized, steps were taken to eliminate them or minimize exposure to them. Thorotrast is no longer used, and exposure of workers to vinyl chloride is strictly regulated.

Anabolic steroids

Anabolic steroids are male hormones used by some athletes to increase their strength and muscle mass. Long-term anabolic steroid use can slightly increase the risk of hepatocellular cancer. Cortisone-like steroids, such as hydrocortisone, prednisone, and dexamethasone, do not carry this same risk.

Arsenic

Drinking water contaminated with naturally occurring arsenic, such as that from some wells, over a long period of time increases the risk of some types of liver cancer. This is more common in parts of East Asia, but it might also be a concern in some areas of the United States.

Infection with parasites

Infection with the parasite that causes schistosomiasis can cause liver damage and is linked to liver cancer. This parasite is not found in the US, but infection can occur in Asia, Africa, and South America.

Tobacco use

Smoking increases the risk of getting liver cancer. Former smokers have a lower risk than current smokers, but both groups have a higher risk than those who never smoked.

Factors with unclear effects on liver cancer risk

Birth control pills

In rare cases, birth control pills, also known as *oral contraceptives*, can cause benign tumors called *hepatic adenomas*. But it is not known if they increase the risk of hepatocellular cancer. Some of the studies that have looked at this issue have suggested there may be a link, but most of the studies were not of high quality and looked at types of pills that are no longer used. Current birth control pills use different types of estrogens, different estrogen doses, and different combinations of estrogens with other hormones. It is not known if the newer pills increase liver cancer risk.

Do we know what causes liver cancer?

Although several risk factors for hepatocellular cancer are known (see "What are the risk factors for liver cancer?"), exactly how these may lead normal liver cells to become cancerous is only partially understood.

Cancers develop when a cell's DNA is damaged. 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. But DNA affects more than how we look.

Some genes have instructions for controlling when cells grow, divide into new cells, and die. Some genes that tell cells to grow and divide are called *oncogenes*. Genes 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 changes that turn on oncogenes or turn off tumor suppressor genes. Several different genes usually need to have changes for a cell to become cancerous.

Certain chemicals that cause liver cancer, such as aflatoxins, are known to damage the DNA in liver cells. For example, studies have shown that aflatoxins can damage the *TP53* tumor suppressor gene, which normally works to prevent cells from growing too much. Damage to the *TP53* gene can lead to increased growth of abnormal cells and formation of cancers.

Infection of liver cells with hepatitis viruses can also damage DNA. These viruses have their own DNA, which carries instructions on how to infect cells and produce more viruses. In some patients, this viral DNA can insert itself into a liver cell's DNA, where it may affect the cell's genes. But scientists still don't know exactly how this might lead to cancer.

Liver cancer clearly has many different causes, and there are undoubtedly many different genes involved in its development. It is hoped that a more complete understanding of how liver cancers develop will help doctors find ways to better prevent and treat them.

Can liver cancer be prevented?

Many liver cancers could be prevented by reducing exposures to known risk factors for this disease.

Avoiding and treating hepatitis infections

Worldwide, the most significant risk factor for liver cancer is chronic infection with hepatitis B virus (HBV) and hepatitis C virus (HCV). These viruses can spread from person to person through sharing contaminated needles (such as in drug use) and through unprotected sex, so some of these cancers may be prevented by not sharing needles and by using safer sex practices (such as consistent use of condoms).

A vaccine to help prevent HBV infection has been available since the early 1980s. The US Centers for Disease Control and Prevention (CDC) recommends that all children, as well as adults at risk get this vaccine to reduce the risk of hepatitis and liver cancer.

There is no vaccine for HCV. Preventing HCV infection, as well as HBV infection in people who have not been immunized, is based on understanding how these infections occur. These viruses can be spread through sharing contaminated needles (such as in drug use), unprotected sex, and through childbirth.

Blood transfusions were once a major source of hepatitis infection as well. But because blood banks in the United States test donated blood to look for these viruses, the risk of getting a hepatitis infection from a blood transfusion is extremely low.

People at high risk for HBV or HCV should be tested for these infections so they can be watched for liver disease and treated if needed.

According to the CDC, you are at risk of having hepatitis B if you:

- Have sex with someone who is infected
- Have multiple sex partners
- Have a sexually transmitted disease
- Are a man who has sex with other men
- Inject drugs
- Live with a person who has chronic HBV

- Travel to countries where many people have HBV
- Are exposed to blood on the job
- Get long-term hemodialysis

A baby born to a mother that is infected with HBV is also at risk for being infected.

The CDC recommends that you get tested for HCV if any of the following are true:

- You were born from 1945 through 1965 (this is because most of the people in the US that are infected with HCV were born in these years)
- You ever injected drugs (even just once or a long time ago)
- You needed medicine for a blood clotting problem before 1987
- You received a blood transfusion or organ transplant before July 1992 (when blood and organs started being screened for HCV)
- You are on long-term hemodialysis
- You are infected with HIV

Treatment of chronic HCV infection can eliminate the virus in many people.

A number of drugs are used to treat chronic HBV. These drugs reduce the number of viruses in the blood and lessen liver damage. Although they do not cure the disease, they lower the risk of cirrhosis and might lower the risk of liver cancer, as well.

Limiting alcohol and tobacco use

Drinking alcohol can lead to cirrhosis, which in turn, can lead to liver cancer. Not drinking alcohol or drinking only in moderation could help prevent liver cancer.

Since smoking also increases the risk of liver cancer, not smoking will also prevent some of these cancers. If you smoke, quitting will help lower your risk of this cancer, as well as many other cancers and life-threatening diseases.

Getting to and staying at a healthy weight

Avoiding obesity might be another way to help protect against liver cancer. People who are obese are more likely to have fatty liver disease and diabetes, both of which have been linked to liver cancer.

Limiting exposure to cancer-causing chemicals

Changing the way certain grains are stored in tropical and subtropical countries could reduce exposure to cancer-causing substances such as aflatoxins. Many developed countries already have regulations to prevent and monitor grain contamination.

Most developed countries also have regulations to protect consumers and workers from certain chemicals known to cause liver cancer. For example, the US Environmental Protection Agency (EPA) limits the allowable level of arsenic in drinking water in the United States. But this may continue to be a problem in areas of the world where naturally occurring arsenic commonly gets into drinking water.

Treating diseases that increase liver cancer risk

Certain inherited diseases can cause cirrhosis of the liver, increasing a person's risk for liver cancer. Finding and treating these diseases early in life could lower this risk. For example, all children in families with hemochromatosis should be screened for the disease and treated if they have it. Treatment regularly removes small amounts of blood to lower the amount of excess iron in the body.

Can liver cancer be found early?

It is often hard to find liver cancer early because signs and symptoms often do not appear until it is in its later stages. Small liver tumors are hard to detect on a physical exam because most of the liver is covered by the right rib cage. By the time a tumor can be felt, it might already be quite large.

There are no widely recommended screening tests for liver cancer in people who are not at increased risk. (Screening is testing for cancer in people without any symptoms.) But testing might be recommended for some people at higher risk.

Many patients who develop liver cancer have long-standing cirrhosis (scar tissue formation from liver cell damage). Doctors may do tests to look for liver cancer if a patient with cirrhosis gets worse for no apparent reason.

For people at higher risk of liver cancer due to cirrhosis (from any cause) or chronic hepatitis B infection (even without cirrhosis), some experts recommend screening for liver cancer with alpha-fetoprotein (AFP) blood tests and ultrasound exams every 6 to 12 months. In some studies, screening was linked to improved survival from liver cancer.

Ultrasound uses sound waves to take pictures of internal organs.

AFP is a protein that can be present at increased levels in patients with liver cancer. But looking at AFP levels isn't a perfect test for liver cancer. Many patients with early liver

cancer have normal AFP levels. Also, AFP levels can be increased from other kinds of cancer as well as some non-cancerous liver conditions.

The American Cancer Society does not have recommendations for liver cancer screening.

Signs and symptoms of liver cancer

Signs and symptoms of liver cancer often do not show up until the later stages of the disease, but sometimes they may show up sooner. If you go to your doctor when you first notice symptoms, your cancer might be diagnosed earlier, when treatment is most likely to be helpful. Some of the most common symptoms of liver cancer are:

- Weight loss (without trying)
- Loss of appetite
- Feeling very full after a small meal
- Nausea or vomiting
- An enlarged liver, felt as a mass under the ribs on the right side
- An enlarged spleen, felt as a mass under the ribs on the left side
- Pain in the abdomen or near the right shoulder blade
- Swelling or fluid build-up in the abdomen
- Itching
- Yellowing of the skin and eyes (jaundice)

Some other symptoms can include fever, enlarged veins on the belly that can be seen through the skin, and abnormal bruising or bleeding.

People who have chronic hepatitis or cirrhosis may feel worse than usual or just have changes in lab test results, such as alpha-fetoprotein (AFP) levels.

Some liver tumors make hormones that act on organs other than the liver. These hormones may cause:

- High blood calcium levels (hypercalcemia), which can cause nausea, confusion, constipation, weakness, or muscle problems
- Low blood sugar levels (hypoglycemia), which can cause fatigue or fainting
- Breast enlargement (gynecomastia) and/or shrinkage of the testicles in men

- High counts of red blood cells (erythrocytosis) which can cause someone to look red and flushed
- High cholesterol levels

Many of the signs and symptoms of liver cancer can also be caused by other conditions, including other liver problems. Still, if you have any of these problems, it's important to see your doctor right away so the cause can be found and treated, if needed.

How is liver cancer diagnosed?

If you have some of the signs and symptoms of liver cancer, your doctor will try to find if they are caused by liver cancer or something else.

Medical history and physical exam

Your doctor will ask about your medical history to check for risk factors and learn more about your symptoms. Your doctor will also examine you to look for signs of liver cancer and other health problems, probably paying special attention to your abdomen and check your skin and the whites of your eyes looking for jaundice (a yellowish color).

If symptoms and/or the results of the physical exam suggest you might have liver cancer, other tests will probably be done. These might include imaging tests, lab tests, and other procedures.

Imaging tests

Imaging tests use x-rays, magnetic fields, or sound waves to create pictures of the inside of your body. Imaging tests are done for a number of reasons, including:

- To help find suspicious areas that might be cancerous
- To help diagnose liver cancer
- To help a doctor guide a biopsy needle into a suspicious area to take a sample
- To learn how far cancer might have spread
- To help guide certain treatments in the liver
- To help determine if treatment has been effective
- To look for a possible recurrence of the cancer

People who have (or may have) liver cancer may get one or more of the following tests.

Ultrasound

Ultrasound is often the first test used to look at the liver.

Ultrasound (ultrasonography) is the use of sound waves to create an image on a video screen. A small instrument called a *transducer* gives off sound waves and picks up the echoes as they bounce off the organs. The echoes are converted by a computer into a black-and-white image. This test can show masses (tumors) growing in the liver, which can then be tested for cancer, if needed.

This is a very easy test to have, and it uses no radiation. For most ultrasound exams, you simply lie on a table while the transducer (which is shaped like a wand) is moved around on the skin over the part of your body being looked at. Usually, the skin is first lubricated with gel.

Computed tomography (CT)

The CT scan is an x-ray test that produces detailed cross-sectional images of your body. A CT scan of the abdomen can help identify many types of liver tumors. It can provide precise information about the size, shape, and position of any tumors in the liver or elsewhere in the abdomen, as well as nearby blood vessels. CT scans can also be used to guide a biopsy needle precisely into a suspected tumor (called a *CT-guided needle biopsy*). If you are found to have liver cancer, a CT of your chest may also be done to look for possible spread to the lungs.

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 take longer than regular x-rays, and you might feel a bit confined by the ring while the pictures are being taken.

For this test, 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 (IV contrast) is injected. This helps better outline structures in your body. The injection can cause some flushing (redness and warm feeling). Some people are allergic and get hives or, rarely, more serious reactions like trouble breathing and low blood pressure. Be sure to tell the doctor if you have any allergies or ever had a reaction to any contrast material used for x-rays.

If your doctor suspects you may have liver cancer, you may have one set of CT scans of your abdomen taken before you get IV contrast. Other sets of scans may then be taken over the next several minutes as the contrast passes through the liver and other parts of the body. These sets of scans (together known as a *3-phase*, *4-phase*, or *multiphase CT scan*) can sometimes help tell a benign tumor from a malignant one.

Magnetic resonance imaging (MRI)

Like CT scans, 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.

When MRI is used to look at liver tumors, several sets of images may be taken. After the first set is done, a contrast material called *gadolinium* is injected into a vein to help see details more clearly. Then other sets are taken over the next several minutes as the contrast moves through the liver and other parts of the body. This is known as *3-phase, 4-phase, or dynamic contrast-enhanced MRI*.

MRI scans can be very helpful in looking at liver tumors. Sometimes they can tell a benign tumor from a malignant one. They can also be used to look at blood vessels in and around the liver, and can help show if liver cancer has spread to other parts of the body.

MRI scans may be a little more uncomfortable than CT scans, and they often take longer. You may be placed inside a narrow tube, which is confining and can upset people with a fear of enclosed spaces. Special more open MRI machines can sometimes be used instead, but the drawback is that the pictures may not be as clear. The MRI machine also makes buzzing and clicking noises that you may find disturbing. Some places will provide earplugs to help block these noises out.

Angiography

An angiogram is an x-ray test that looks at blood vessels. Contrast medium, or dye, is injected into an artery to outline blood vessels while x-ray images are taken. Angiography can be used to show the arteries that supply blood to a liver cancer, which can help doctors decide if a cancer can be removed and to help plan the operation. It can also be used to help guide some types of non-surgical treatment, such as embolization (see the section "Embolization therapy for liver cancer").

Angiography can be uncomfortable because a small catheter (a flexible hollow tube) must be put into the artery leading to the liver to inject the dye. Usually the catheter is put into an artery in your groin and threaded up into the liver artery. You have to stay very still while the catheter is in place. A local anesthetic is often used to numb the area before inserting the catheter. Then the dye is injected quickly to outline all the vessels while the x-rays are being taken.

Angiography may also be done with a CT scanner (CT angiography) or an MRI scanner (MR angiography). These techniques are often used instead of x-ray angiography because they can give information about the blood vessels in the liver without the need for a catheter in the artery. You will still need an IV line so that a contrast dye can be injected into the bloodstream during the imaging.

Bone scan

A bone scan can help look for cancer that has spread (metastasized) to bones. Doctors don't usually order this test for people with liver cancer unless you have symptoms such as bone pain, or if there's a chance you may be eligible for a liver transplant to treat your cancer.

For this test, a small amount of low-level radioactive material is injected into a vein (IV). The substance settles in areas of damaged bone throughout the entire skeleton over the course of 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 the skeleton.

Areas of active bone changes appear as "hot spots" on the skeleton – that is, they attract the radioactivity. These areas may suggest the presence of cancer, but other bone diseases can also cause the same pattern. Other tests such as plain x-rays or MRI scans, or even a bone biopsy might be needed to know what is causing any hot spots.

More information on imaging tests can be found on our website, or in our document *Imaging (Radiology) Tests*.

Other tests and procedures

Other types of tests may be done if your doctor thinks you might have liver cancer but the imaging test results aren't conclusive.

Laparoscopy

In this procedure, a doctor inserts a thin, lighted tube with a small video camera on the end through a small incision (cut) in the front of the abdomen to look at the liver and other internal organs. (Sometimes more than one cut is made.) This procedure is done in the operating room. Usually you are under general anesthesia (in a deep sleep), although in some cases you may be sedated (made sleepy) and the area of the incision will be numbed.

Laparoscopy can help plan surgery or other treatments, and can help doctors confirm the stage (extent) of the cancer. If needed, doctors can also insert instruments through the incisions to remove biopsy samples, which are then looked at under a microscope to make or confirm the diagnosis of cancer.

Laparoscopy is usually done at an outpatient surgery center. Because the surgeon only makes a small incision to insert the tubes, you should not have much pain after surgery. You should be able to go home after you recover from the anesthesia.

Biopsy

A biopsy is the removal of a sample of tissue to see if it is cancer. Sometimes, the only way to be certain that liver cancer is present is to take a biopsy and look at it under a microscope.

But in some cases, doctors can be fairly certain that a person has liver cancer based on the results of imaging tests such as CT and MRI scans. In these cases, a biopsy may not be needed. Doctors are often concerned that sticking a needle into the tumor or otherwise disturbing it without completely removing it might help cancer cells spread to other areas. This is a major concern if a liver transplant might be an option to try to cure the cancer, as any spread of the cancer might make the person ineligible for a transplant. That is why some experts recommend that patients who could be transplant candidates only have biopsies done at the center where the transplant will be done.

If a biopsy is needed, it can be done in several ways.

Needle biopsy: A hollow needle is placed through the skin in the abdomen and into the liver. The skin is first numbed with local anesthesia before the needle is placed. Different-sized needles may be used.

- For a fine needle aspiration (FNA) biopsy, tumor cells are sucked into a very thin needle with a syringe.
- A core needle biopsy uses a slightly larger needle to get a bigger sample.

There are pros and cons to both types of needle biopsies. FNA can usually confirm a cancer, but sometimes it doesn't provide enough information to be sure about the type of cancer. Some doctors prefer a core needle biopsy over an FNA, as it provides a larger sample and therefore, more information about the tumor. But the risk of complications is lower with FNA, especially when tumors are near large blood vessels.

The doctor may use ultrasound or CT scanning to guide the needle into the tumor. With this approach, the doctor slowly advances the needle while checking its position with one of these imaging tests. When the images show that the needle is in the tumor, a sample is removed and sent to the lab to be looked at under a microscope.

Laparoscopic biopsy: Biopsy specimens can also be taken during laparoscopy. This lets the doctor see the surface of the liver and take samples of abnormal-appearing areas.

Surgical biopsy: In some cases, a biopsy sample may not be obtained until surgery that is meant to treat the tumor. An incisional biopsy (removing a piece of the tumor) or an excisional biopsy (removing the entire tumor and some surrounding normal liver tissue) can be done during an operation. But since doctors often prefer to know the exact type of tumor before surgery, other types of biopsy methods may be used.

For more information about biopsies and how they are tested, see our document *Testing Biopsy and Cytology Specimens for Cancer*.

Lab tests

Your doctor may order lab tests for a number of reasons:

- To help diagnose liver cancer
- To help determine what might have caused your liver cancer
- To learn how well your liver is working, which can affect what types of treatments you can have
- To get an idea of your general health and how well your other organs are working, which also could affect what types of treatments you can have
- To see how well treatment is working
- To look for signs that the cancer has come back after treatment

Alpha-fetoprotein blood (AFP) test

AFP is a protein that is normally present at high levels in the blood of fetuses but goes down to low levels shortly after birth. Levels in the blood of adults can go up from liver disease, liver cancer, or other cancers.

If AFP levels are very high in someone with a liver tumor, it can be a sign that liver cancer is present. But because liver cancer isn't the only reason for high AFP levels and many patients with early liver cancer have normal levels of AFP, it isn't very helpful in determining if a liver mass might be cancer.

This test is sometimes useful in people already diagnosed with liver cancer. The AFP level can help determine what treatment might be an option. During treatment, the test can be used to help give an idea of how well it is working, as the AFP level should go down if treatment is effective. The test can be used after treatment as well, to look for possible signs that the cancer has come back (recurred).

Other blood tests

Liver function tests (LFTs): Because liver cancer often develops in livers already damaged by hepatitis and/or cirrhosis, doctors need to know the condition of your liver before starting your treatment. A series of blood tests can measure levels of certain substances in your blood that show how well your liver is working.

If the part of your liver not affected by cancer isn't working well, you might not be able to have surgery to try to cure the cancer, as the surgery might require removal of a large part of your liver. This is a common problem in people with liver cancer.

Blood clotting tests: The liver also makes proteins that help blood clot when you are bleeding. A damaged liver might not make enough of these clotting factors, which could increase your risk of bleeding. Your doctor may order blood tests such as a prothrombin time (PT) to help assess this risk.

Tests for viral hepatitis: Your doctor might order blood tests to check for hepatitis B and C.

Kidney function tests: Tests of blood urea nitrogen (BUN) and creatinine levels are often done to assess how well your kidneys are working.

Complete blood count (CBC): This test measures levels of red blood cells (which carry oxygen throughout the body), white blood cells (which fight infections), and platelets (which help the blood clot). It gives an idea of how well the bone marrow, where new blood cells are made, is functioning.

Blood chemistry tests and other tests: Blood chemistry tests check the levels of a number of minerals and other substances in the blood, some of which might be affected by liver cancer. For example, liver cancer can raise blood levels of calcium, while blood glucose levels may fall. Liver cancer can also sometimes raise cholesterol levels, so this may be checked as well.

How is liver cancer staged?

The stage of cancer is a description of how widespread it is. The stage of a liver cancer is one of the most important factors in considering treatment options.

A staging system is a standard way for the cancer care team to sum up information about how far a cancer has spread. Doctors use staging systems to get an idea about a patient's prognosis (outlook) and to help determine the most appropriate treatment.

There are several staging systems for liver cancer, and not all doctors use the same system.

The American Joint Committee on Cancer (AJCC) TNM system

This staging system is based on the results of the physical exam, imaging tests (ultrasound, CT or MRI scan, etc.) and other tests, which are described in the section “How is liver cancer diagnosed?” as well as by the results of surgery if it has been done.

The TNM system for staging contains 3 key pieces of information:

- **T** describes the number and size of the primary **tumor(s)**, measured in centimeters (cm), and whether the cancer has grown into nearby blood vessels or organs.
- **N** describes the extent of spread to nearby (regional) lymph **nodes**.
- **M** indicates whether the cancer has **metastasized** (spread) to distant parts of the body.

Numbers or letters that appear after T, N, and M 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 groups

TX: Primary tumor cannot be assessed

T0: No evidence of primary tumor

T1: A single tumor (any size) that hasn't grown into blood vessels

T2: Either a single tumor (any size) that has grown into blood vessels, OR more than one tumor but no tumor is larger than 5 cm (about 2 inches) across

T3a: More than one tumor, with at least one tumor larger than 5 cm across

T3b: At least one tumor (any size) that has grown into a major branch of a large vein of the liver (the portal or hepatic vein)

T4: The tumor (any size) has grown into a nearby organ (other than the gallbladder), OR the tumor is growing into the thin layer of tissue covering the liver (called the visceral peritoneum)

N groups

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

N0: The cancer has not spread to the regional lymph nodes.

N1: The cancer has spread to the regional lymph nodes.

M groups

M0: The cancer has not spread to distant lymph nodes or other organs.

M1: The cancer has spread to distant lymph nodes or other organs. Liver cancer most often spreads to the lining of the belly (peritoneum), the lungs, and to bones.

Stage grouping

Once the T, N, and M groups have been determined, they are then combined to give an overall stage, using Roman numerals I to IV (1 to 4):

Stage I: T1, N0, M0: There is a single tumor (any size) that has not grown into any blood vessels. The cancer has not spread to nearby lymph nodes or distant sites.

Stage II: T2, N0, M0: Either there is a single tumor (any size) that has grown into blood vessels, OR there are several tumors, and all are 5 cm (2 inches) or less across. The cancer has not spread to nearby lymph nodes or distant sites.

Stage IIIA: T3a, N0, M0: There is more than one tumor, and at least one is larger than 5 cm (2 inches) across. The cancer has not spread to nearby lymph nodes or distant sites.

Stage IIIB: T3b, N0, M0: At least one tumor is growing into a branch of a major vein of the liver (portal vein or hepatic vein). The cancer has not spread to nearby lymph nodes or distant sites.

Stage IIIC: T4, N0, M0: A tumor is growing into a nearby organ (other than the gallbladder), OR a tumor has grown into the outer covering of the liver. The cancer has not spread to nearby lymph nodes or distant sites.

Stage IVA: Any T, N1, M0: Tumors in the liver can be any size or number and they may have grown into blood vessels or nearby organs. The cancer has spread to nearby lymph nodes. The cancer has not spread to distant sites.

Stage IVB: Any T, Any N, M1: The cancer has spread to other parts of the body. (Tumors can be any size or number, and nearby lymph nodes may or may not be involved.)

Other liver cancer staging systems

The staging systems for most types of cancer depend only on the extent of the cancer, but liver cancer is complicated by the fact that most patients have damage to the rest of their liver along with the cancer. This also affects treatment options and prognosis.

Although the TNM system defines the extent of liver cancer in some detail, it does not take liver function into account. Several other staging systems have been developed that include both of these factors:

- The Barcelona Clinic Liver Cancer (BCLC) system
- The Cancer of the Liver Italian Program (CLIP) system
- The Okuda system

These staging systems have not been compared against each other. Some are used more than others in different parts of the world, but at this time there is no single staging system that all doctors use. If you have questions about the stage of your cancer or which system your doctor uses, be sure to ask.

Child-Pugh score (cirrhosis staging system)

The Child-Pugh score is a measure of liver function, especially in people with cirrhosis. Many people with liver cancer also have cirrhosis, and in order to treat the cancer, doctors

need to know how well the liver is working. This system looks at 5 factors, the first 3 of which are results of blood tests:

- Blood levels of bilirubin (the substance that can cause yellowing of the skin and eyes)
- Blood levels of albumin (a major protein normally made by the liver)
- The prothrombin time (measures how well the liver is making blood clotting factors)
- Whether there is fluid (ascites) in the abdomen
- Whether the liver disease is affecting brain function

Based on these factors, liver function is divided into 3 classes. If all these factors are normal, then liver function is called *class A*. Mild abnormalities are *class B*, and severe abnormalities are *class C*. People with liver cancer and class C cirrhosis are often too sick for surgery or other major cancer treatments.

The Child-Pugh score is actually part of the BCLC and CLIP staging systems mentioned previously.

Potentially resectable or transplantable, unresectable, inoperable with only local disease, and advanced liver cancer

Formal staging systems such as those described before can often help doctors determine a patient's prognosis (outlook). But for treatment purposes, doctors often classify liver cancers more simply, based on whether or not they can be entirely cut out (resected). Resectable is the medical term meaning "able to be removed by surgery."

Potentially resectable or transplantable cancers

These cancers can be completely removed by surgery or treated with liver transplant and the patient is healthy enough to tolerate the surgery. This would include most stage I and some stage II cancers in the TNM system, in patients who do not have cirrhosis or other serious medical problems. Only a small number of patients with liver cancer have tumors in this group.

Unresectable cancers

Cancers that have not spread to the lymph nodes or distant organs but cannot be completely removed by surgery are classified as unresectable. This includes cancers that have spread throughout the liver or can't be safely removed because they are close to the area where the liver meets the main arteries, veins, and bile ducts.

Inoperable with only local disease

This means that the cancer is small enough and in the right place to be removed but you aren't healthy enough for surgery. Often this is because the non-cancerous part of your liver is not healthy (because of cirrhosis, for example), and surgery to remove the cancer might not leave enough liver tissue for it to function properly. It could also mean that you have serious medical problems that make surgery unsafe.

Advanced (metastatic) cancers

Cancers that have spread to lymph nodes or other organs are classified as advanced. These would include stages IVA and IVB cancers in the TNM system. Most advanced liver cancers cannot be treated with surgery.

Survival rates for liver cancer

Survival rates are often used by doctors as a standard way of discussing a person's prognosis (outlook). Some patients might 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 do not want to read about the survival statistics for liver cancer, 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 of these people live much longer than 5 years. Five-year *relative* survival rates, such as the numbers below, assume that some people will die of other causes and compare the observed survival with that expected for people without the cancer. This is a more accurate way to describe the prognosis for patients with a particular type and stage of cancer.

To get 5-year survival rates, doctors have to look at people who were treated at least 5 years ago. Although the numbers below are among the most current we have available, improvements in treatment since then may result in a more favorable outcome for people now being diagnosed with liver 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 to any particular person. Knowing the type and the stage of a person's cancer is important in estimating their outlook. But many other factors may also affect a person's outcome, such as a person's overall health (especially whether or not they have cirrhosis), the treatment received, and how well the cancer responds to treatment. Even when taking these other factors into account, survival rates are rough estimates at best. Your doctor can tell you how and if the numbers below apply to you.

The numbers below come from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database, and are based on patients who were diagnosed with liver cancer (hepatocellular type) between 2003 and 2009.

The SEER database does not divide liver cancer survival rates by AJCC TNM stages. Instead, it groups cancer cases into summary stages:

- **Localized** means the cancer is still confined to the liver, and includes stages I, II, and some stage III cancers. This includes a wide range of cancers, some of which are easier to treat than others.
- **Regional** means the cancer has grown into nearby organs or has spread to nearby lymph nodes, and includes stages IIIC and IVA cancers.
- **Distant** means that the cancer has spread to distant organs or tissues and is the same as stage IVB.

Stage	5-year Relative Survival Rate
Localized	28%
Regional	7%
Distant	2%

For all stages combined, the relative 5-year survival rate from liver cancer is about 15%. Part of the reason for this low survival rate is that most patients with liver cancer also have other liver problems such as cirrhosis, which itself can be fatal.

In general, survival rates are higher for people who can have surgery to remove their cancer, regardless of the stage. For example, studies have shown that patients with small, resectable tumors who do not have cirrhosis or other serious health problems are likely to do well if their cancers are removed. Their overall 5-year survival is over 50%. For people with early-stage liver cancers who have a liver transplant, the 5-year survival rate is in the range of 60% to 70%.

How is liver 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.

General treatment information

After liver cancer is diagnosed and staged, your cancer care team will discuss your treatment options with you. Depending on your situation, you may have different types of doctors on your treatment team. These doctors may include:

- A surgeon: a doctor who treats diseases with surgery.
- A radiation oncologist: a doctor who treats cancer with radiation therapy.
- A medical oncologist: a doctor who treats cancer with medicines such as chemotherapy.
- A gastroenterologist: a doctor who specializes in treating diseases of the digestive system, including the liver.

Many other specialists may be involved in your care as well, including nurse practitioners, nurses, nutrition specialists, social workers, and other health professionals.

In creating your treatment plan, important factors to consider include the stage (extent) of the cancer and the health of the rest of your liver. But you and your cancer care team will also want to take into account the possible side effects of treatment, your overall health, and the chances of curing the disease, extending life, or relieving symptoms. Based on these factors, your treatment options may include:

- Surgery (partial hepatectomy or liver transplant)
- Tumor ablation
- Tumor embolization
- Radiation therapy
- Targeted therapy
- Chemotherapy

In some cases, doctors may recommend combining more than one of these treatments. It is important to discuss all of your treatment options, including their goals and possible side effects, with your doctors to help make the decision that best fits your needs. It's also very important to ask questions if there is anything you're not sure about. You can find some good questions to ask in the section "What should you ask your doctor about liver cancer?"

If time permits, it might also be a good idea to seek a second opinion, especially from doctors experienced in treating liver cancer. A second opinion might provide more information and help you feel more confident about the treatment plan being considered.

The next few sections describe the various types of treatments used for liver cancer. This is followed by a description of the most common approaches used for these cancers based on their stage.

Liver cancer surgery

At this time, surgery, either with resection (removal of the tumor) or a liver transplant, offers the only reasonable chance to cure liver cancer. If all cancer in the liver is successfully removed, you will have the best outlook.

Partial hepatectomy

Surgery to remove part of the liver is called *partial hepatectomy*. This operation is considered for a single tumor that has not grown into blood vessels. It is only an option in patients with good liver function who are healthy enough for surgery. Unfortunately, most liver cancers cannot be completely removed. Often the cancer is in too many different parts of the liver, is too large, or has spread beyond the liver.

Imaging tests, such as CT or MRI with angiography are done first to see if the cancer can be removed completely. Still, sometimes during surgery the cancer is found to be too large or spread too far to be removed, and the surgery has to be cancelled.

Most patients with liver cancer in the United States also have cirrhosis. In someone with severe cirrhosis, removing even a small amount of liver tissue at the edges of a cancer might not leave enough liver behind to perform essential functions. People with cirrhosis are eligible for surgery only if the cancer is small and they still have a reasonable amount of liver function left. Doctors often assess this function by assigning a Child-Pugh score (see the section “How is liver cancer staged?”), which is a measure of cirrhosis based on certain lab tests and symptoms. Patients in class A are most likely to have enough liver function to have surgery. Patients in class B are less likely to be able to have surgery. Surgery is not typically an option for patients in class C.

Possible risks and side effects: Liver resection is a major, serious operation that should only be done by skilled and experienced surgeons. Because people with liver cancer usually have liver problems besides the cancer, surgeons have to remove enough of the liver to try to get all of the cancer, yet leave enough behind for the liver to function adequately.

A lot of blood passes through the liver, and bleeding after surgery is a major concern. On top of this, the liver normally makes substances that help the blood clot. Damage to the liver (both before the surgery and during the surgery itself) can add to potential bleeding problems.

Other possible problems are similar to those seen with other major surgeries and can include infections, complications from anesthesia, blood clots, and pneumonia.

Another concern is that because the remaining liver still has the underlying disease that led to the cancer, sometimes a new liver cancer can develop afterward.

Liver transplant

When it is available, a liver transplant may be the best option for some people with small liver cancers. At this time, liver transplants can be an option for those with tumors that cannot be removed with surgery, either because of the location of the tumors or because the liver is too diseased for the patient to withstand removing part of it. In general, it is used to treat patients with small tumors (either 1 tumor smaller than 5 cm across or 2 to 3 tumors no larger than 3 cm) that have not invaded nearby blood vessels. It can also rarely be an option for patients with resectable cancers (cancers that can be removed completely).

According to the Organ Procurement and Transplantation Network, about 1,300 liver transplants were done in people with cancer in the liver in the United States in 2012, the last year for which numbers are available. In most cases, the patients had liver cancer but some had bile duct cancer.

With a transplant, not only is the risk of a second new liver cancer significantly reduced, but the new liver will function normally.

Unfortunately, the opportunities for liver transplants are limited. Only about 6,000 livers are available for transplant each year, and most of these are used for patients with diseases other than liver cancer. Increasing awareness about the importance of organ donation is an essential public health goal that could make this treatment available to more patients with liver cancer and other serious liver diseases.

Most livers used for transplants come from people who have just died. But in recent years, a small number of patients have received part of a liver from a living donor (usually a close relative) for transplant. The liver can regenerate some of its lost function over time if part of it is removed. Still, the surgery does carry some risks for the donor. Less than 250 living donor liver transplants are done in the United States each year. Only a small number of them are for patients with liver cancer.

People needing a transplant must wait until a liver is available, which can take too long for some people with liver cancer. In many cases a person may get other treatments, such as embolization or ablation (described in following sections), while waiting for a liver transplant. Or doctors may suggest surgery or other treatments first and then a transplant if the cancer comes back.

Possible risks and side effects: Like partial hepatectomy, a liver transplant is a major operation with serious risks (bleeding, infection, blood clots, complications from anesthesia, etc.). But there are some additional risks after this surgery.

People who get a liver transplant have to be given drugs to help suppress their immune systems to prevent their bodies from rejecting the new organ. These drugs have their own risks and side effects, especially the risk of getting serious infections. By suppressing the immune system, these drugs might also allow any liver cancer that had spread outside of the liver to grow even faster than before. Some of the drugs used to prevent rejection can also cause high blood pressure, high cholesterol, diabetes, can weaken the bones and kidneys, and can even lead to a new cancer.

After a liver transplant, regular blood tests are important to check for signs of the body rejecting the new liver. Sometimes liver biopsies are also taken to see if rejection is occurring and if changes are needed in the anti-rejection medicines.

Tumor ablation for liver cancer

Ablation refers to treatments that destroy liver tumors without removing them. These techniques are often used in patients with no more than a few small tumors but for whom surgery is not a good option (often because of poor health or reduced liver function). They are less likely to cure the cancer than surgery, but they can still be very helpful for some people. These treatments are also sometimes used in patients waiting for a liver transplant.

Ablation is best used for tumors no larger than about 3 cm across (a little over an inch). For slightly larger tumors (3 to 5 cm across), it may be used along with embolization (see next section). Because ablation often destroys some of the normal tissue around the tumor, it might not be a good choice for treating tumors near major blood vessels, the diaphragm, or major bile ducts.

This type of treatment typically does not require a hospital stay. Often, ablation can be done without surgery by inserting a needle or probe into the tumor through the skin. The needle or probe is guided into place with ultrasound or CT scanning. Sometimes, though, to be sure the treatment is aimed at the right place, it may be done during surgery.

Radiofrequency ablation (RFA)

This procedure uses high-energy radio waves for treatment. The doctor inserts a thin, needle-like probe into the tumor. A high-frequency current is then passed through the tip of the probe, which heats the tumor and destroys the cancer cells. This is a common treatment method for small tumors.

Ethanol (alcohol) ablation

This is also known as *percutaneous ethanol injection (PEI)*. In this procedure, concentrated alcohol is injected directly into the tumor to kill cancer cells.

Microwave thermotherapy

In this procedure, microwaves transmitted through the probe are used to heat and destroy the abnormal tissue.

Cryosurgery (cryotherapy)

This procedure destroys a tumor by freezing it using a thin metal probe. The probe is guided into the tumor and then very cold gasses are passed through the probe to freeze the tumor, killing the cancer cells. This method may be used to treat larger tumors than the other ablation techniques, but it sometimes requires general anesthesia (where you are deeply asleep and not able to feel pain).

Side effects of ablation therapy

Possible side effects after ablation therapy include abdominal pain, infection in the liver, and bleeding into the chest cavity or abdomen. Serious complications are uncommon, but they are possible.

Embolization therapy for liver cancer

Embolization is a procedure that injects substances to try to block or reduce the blood flow to cancer cells in the liver.

The liver is unusual in that it has 2 blood supplies. Most normal liver cells are fed by branches of the portal vein, whereas cancer cells in the liver are usually fed by branches of the hepatic artery. Blocking the branch of the hepatic artery feeding the tumor helps kill off the cancer cells, but it leaves most of the healthy liver cells unharmed because they get their blood supply from the portal vein.

Embolization is an option for some patients with tumors that cannot be removed by surgery. It can be used for tumors that are too large to be treated with ablation (usually larger than 5 cm across). It can also be used with ablation. Embolization does reduce some of the blood supply to the normal liver tissue, so it may not be a good option for some patients whose liver has been damaged by diseases such as hepatitis or cirrhosis.

This type of treatment typically does not require a hospital stay.

It isn't yet clear which of the 3 main types of embolization is better in terms of long-term outcomes.

Arterial embolization

Arterial embolization is also known as *trans-arterial embolization* (or TAE). In this procedure a catheter (a thin, flexible tube) is put into an artery through a small cut in the

inner thigh and threaded up into the hepatic artery in the liver. A dye is usually injected into the bloodstream at this time to help the doctor monitor the path of the catheter via angiography, a special type of x-ray. Once the catheter is in place, small particles are injected into the artery to plug it up.

Chemoembolization

This approach, also known as *trans-arterial chemoembolization* (or TACE) combines embolization with chemotherapy. Most often, this is done either by using tiny beads that give off a chemotherapy drug for the embolization. TACE can also be done by giving chemotherapy through the catheter directly into the artery, then plugging up the artery.

Radioembolization

This technique combines embolization with radiation therapy and is sometimes known as *trans-arterial radioembolization* (or TARE).

In the United States, this is done by injecting small beads (called *microspheres*) that have a radioactive isotope (yttrium-90) stuck to them into the hepatic artery. Brand names for these beads include TheraSphere[®] and SIR-Spheres[®]. Once infused, the beads lodge in the blood vessels near the tumor, where they give small amounts of radiation to the tumor site for several days. The radiation travels a very short distance, so its effects are limited mainly to the tumor.

Side effects of embolization

Possible complications after embolization include abdominal pain, fever, nausea, infection in the liver, gallbladder inflammation, and blood clots in the main blood vessels of the liver. Because healthy liver tissue can be affected, there is a risk that liver function will get worse after embolization. This risk is higher if a large branch of the hepatic artery is embolized. Serious complications are not common, but they are possible.

Radiation therapy for liver cancer

Radiation therapy uses high-energy rays to kill cancer cells. There are different kinds of radiation therapy.

External beam radiation therapy

This type of radiation therapy focuses radiation delivered from outside the body on the cancer. This can sometimes be used to shrink liver tumors to relieve symptoms such as pain, but it is not used as often as other local treatments such as ablation or embolization. Although liver cancer cells are sensitive to radiation, this treatment can't be used at very high doses because normal liver tissue is also easily damaged by radiation.

Before your treatments start, the radiation team will take careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. Radiation therapy is much like getting an x-ray, but the radiation is stronger. The procedure itself is painless. Each treatment lasts only a few minutes, although the setup time – getting you into place for treatment – usually takes longer. Most often, radiation treatments are given 5 days a week for several weeks.

With newer radiation techniques such as 3-dimensional conformal radiation therapy (3D-CRT), doctors can better target liver tumors while reducing the radiation to nearby healthy tissues. This may make it more effective and reduce side effects.

Stereotactic body radiation therapy (SBRT) is a technique that allows treatment to be completed in a short-time. Radiation therapy usually means getting small doses of radiation 5 days a week for several weeks, SBRT uses very focused beams of high-dose radiation given on one or a few days. Beams are aimed at the tumor from many different angles. To target the radiation precisely, the person is put in a specially designed body frame for each treatment.

Radioembolization

As mentioned in the "Embolization therapy for liver cancer" section, tumors in the liver can be treated with radiation by injecting small radioactive beads into the hepatic artery. They lodge in the liver near tumors and give off small amounts of radiation that travel only a short distance.

Side effects of radiation therapy

Side effects of external radiation therapy can include:

- Skin changes, which range from redness (like a sunburn) to blistering and peeling where the radiation enters the body
- Nausea and vomiting
- Fatigue
- Low blood counts

These improve after treatment ends.

Side effects tend to be more severe if radiation and chemotherapy are given together.

For more information on radiation therapy, visit our website or see our document *Understanding Radiation Therapy: A Guide for Patients and Families*.

Targeted therapy for liver cancer

As researchers have learned more about the changes in cells that cause cancer, they have been able to develop newer drugs that specifically target these changes. Targeted drugs work differently from standard chemotherapy drugs (which are described in the “Chemotherapy for liver cancer” section). They often have different (and less severe) side effects.

Like chemotherapy, these drugs work systemically – they enter the bloodstream and reach all areas of the body, which makes them potentially useful against cancers that have spread to distant organs. Because standard chemotherapy has not been effective in most patients with liver cancer, doctors have been looking at targeted therapies more.

Sorafenib

Sorafenib (Nexavar[®]) is a targeted drug that works in 2 ways. It helps block tumors from forming new blood vessels, which they need to grow. It also targets some of the proteins on cancer cells that normally help them grow.

This drug has been shown to slow the growth of advanced liver cancer and to help some patients live longer (by an average of about 3 months). Researchers are also studying its use earlier in the course of the disease, often combined with other types of treatment. It has not been studied much in people who already have poor liver function, so it's not yet clear if it is safe for these people.

Sorafenib is a pill that is taken twice daily. The most common side effects of this drug include fatigue, rash, loss of appetite, diarrhea, high blood pressure, and redness, pain, swelling, or blisters on the palms of the hands or soles of the feet.

More information about targeted therapy drugs can be found in our document *Targeted Therapy*.

Chemotherapy for liver cancer

Chemotherapy (chemo) is treatment with drugs to destroy cancer cells. Systemic (whole body) chemotherapy uses anti-cancer drugs that are injected into a vein or given by mouth. These drugs enter the bloodstream and reach all areas of the body, making this treatment potentially useful for cancers that have spread to distant organs.

Unfortunately, liver cancer resists most chemo drugs. The drugs that have been most effective as systemic chemo in liver cancer are doxorubicin (Adriamycin), 5-fluorouracil, and cisplatin. But even these drugs shrink only a small portion of tumors, and the responses often do not last long. Even with combinations of drugs, in most studies systemic chemo has not helped patients live longer.

Hepatic artery infusion

Because of the poor response to systemic chemo, doctors have studied putting chemo drugs directly into the hepatic artery to see if it might be more effective. This technique is known as *hepatic artery infusion (HAI)*. The chemo goes into the liver through the hepatic artery, but the healthy liver breaks down most of the drug before it can reach the rest of the body. This gets more chemo to the tumor than systemic chemo without increasing side effects. The drugs most commonly used include floxuridine (FUDR), cisplatin, mitomycin C, and doxorubicin.

Early studies have found that HAI is often effective in shrinking tumors, but more research is still needed. This technique may not be useful in all patients because it often requires surgery to insert a catheter into the hepatic artery, an operation that many liver cancer patients may not be able to tolerate.

Side effects of chemotherapy

Chemo drugs attack cells that are dividing quickly, which is why they 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 side effects.

The side effects of chemo depend on the type and dose of drugs given and the length of time they are taken. Common side effects include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Diarrhea
- Increased chance of infections (from low white blood cell counts)
- Easy bruising or bleeding (from low blood platelet counts)
- Fatigue (from low red blood cell counts)

These side effects are usually short-term and go away after treatment is finished. There are often ways to lessen them. For example, drugs can be given to help prevent or reduce nausea and vomiting. Be sure to ask your doctor or nurse about drugs to help reduce side effects.

Along with the possible side effects in the list above, some drugs may have their own specific side effects. Ask your health care team what you can expect.

You should report any side effects you notice while getting chemotherapy to your medical team so that you can be treated promptly. In some cases, the doses of the chemotherapy drugs may need to be reduced or treatment may need to be delayed or stopped to prevent side effects from getting worse.

For more information about chemotherapy and managing side effects, visit our website or see our document *A Guide to Chemotherapy*.

Clinical trials for liver 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 website 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 website at www.cancer.gov/clinicaltrials.

You must meet the requirements of the clinical trial to take part. But even if you do meet them you decide whether or not to enter (enroll in) it.

Clinical trials are one way to get state-of-the-art cancer treatment. Sometimes they may be the only way to get some newer treatments. They are also 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 website or call our toll-free number (1-800-227-2345) and have it sent to you.

Complementary and alternative therapies for liver 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 social media groups and websites 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 few or 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. To learn more about specific complementary and alternative therapies go to our website or call us. 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 of liver cancer, by stage

Although the AJCC (TNM) staging system (see "How is liver cancer staged?") is often used to describe the spread of a liver cancer precisely, doctors use a more practical system to determine treatment options. Liver cancers are categorized as: potentially resectable or transplantable, unresectable, inoperable with only local disease, and advanced.

Potentially resectable or transplantable liver cancer (some T1 or T2, N0, M0 tumors)

Potentially resectable: If your cancer is at an early stage (stage I and some stage II cancers) and the rest of your liver is healthy, surgery (partial hepatectomy) may cure you. Only a small number of people with liver cancer are in this category. An important factor affecting outcome is the size of the tumor(s) and if nearby blood vessels are affected. Larger tumors or those that invade blood vessels are more likely to come back in the liver or spread elsewhere after surgery. The function of the rest of the liver and your general health are also important. For some people with early-stage liver cancer, a liver transplant could be another option.

Clinical trials are now looking at whether patients who have a partial hepatectomy will be helped by getting other treatments in addition to surgery. Some studies have found that using chemoembolization or other treatments along with surgery may help some patients live longer. Still, not all studies have found this, and more research is needed to know the value (if any) of adding other treatments to surgery.

Potentially transplantable: If your cancer is at an early stage, but the rest of your liver isn't healthy, you may be able to be treated with liver transplant. Liver transplant may also be an option if the tumor is in a part of the liver that makes it hard to remove (such as very close to a large blood vessel). Candidates for liver transplant can wait a long time for a liver to be available. While they are waiting, they are often given other treatments, such as ablation or embolization, to keep the cancer in check.

Unresectable liver cancer (some T1 to T4, N0, M0 tumors)

Unresectable cancers include cancers that haven't yet spread to lymph nodes or distant sites, but can't be removed safely by partial hepatectomy because

- The tumor is too large to be removed safely
- The tumor is in a part of the liver that makes it hard to remove (such as very close to a large blood vessel)
- There are several tumors or the cancer has spread throughout the liver

Treatment options include ablation, embolization, or both for the liver tumor(s). Other options may include targeted therapy with sorafenib, chemotherapy (either systemic or by hepatic artery infusion), and/or radiation therapy. In some cases, treatment may shrink the tumor(s) enough so that surgery (partial hepatectomy or transplant) may become possible.

These treatments won't cure the cancer, but they can reduce symptoms and may even help you live longer. Because these cancers can be hard to treat, clinical trials of newer treatments may offer a good option in many cases.

Inoperable with only local disease

These cancers are small enough and in the right place to be removed but the patient isn't healthy enough for surgery. Treatment options include ablation, embolization, or both for the liver tumor(s). Other options may include targeted therapy with sorafenib, chemotherapy (either systemic or by hepatic artery infusion), and/or radiation therapy.

Advanced (metastatic) liver cancers (includes all N1 or M1 tumors)

Advanced liver cancer has spread either to the lymph nodes or to other organs. Because these cancers are widespread, they cannot be treated with surgery.

If your liver is functioning well enough (Child-Pugh class A or B), the targeted therapy drug sorafenib may help control the growth of the cancer for a time and may help you live longer.

As with localized unresectable liver cancer, clinical trials of targeted therapies, new approaches to chemotherapy (new drugs and ways to deliver chemotherapy), new forms of radiation therapy, and other new treatments may help you. These clinical trials are also important for improving the outcome for future patients.

Treatments such as radiation might also be used to help relieve pain and other symptoms. Please be sure to discuss any symptoms you have with your cancer team, so they can treat them effectively.

Recurrent liver cancer

Cancer that comes back after treatment is called *recurrent*. 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 liver cancer that returns after initial therapy depends on many factors, including where it comes back, the type of initial treatment, and how well the liver is functioning. Patients with localized resectable disease that recurs in the liver might be eligible for further surgery or local treatments like ablation or embolization. If the cancer is widespread, targeted therapy (sorafenib) or chemotherapy may be options. Patients may also wish to ask their doctor whether a clinical trial may be right for them.

Treatment can also be given to relieve pain and other side effects. Please be sure to discuss any symptoms you have with your cancer care team, so they may be treated effectively.

For more information on dealing with a recurrence, you may also want to look at our document *When Your Cancer Comes Back: Cancer Recurrence*.

More treatment information about liver 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 website (www.nccn.org).

The NCI provides treatment guidelines via its telephone information center (1-800-4-CANCER) and its website (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 liver cancer?

As you cope with liver cancer and its treatment, we encourage you to have honest, open discussions with your doctor. Ask any question, no matter how small it might seem. Here are some questions you might want to ask. Be sure to add others as you think of them. Nurses, social workers, and other members of your treatment team might also be able to answer many of your questions.

- What kind of liver cancer do I have? (Some types of liver cancer carry a better prognosis than others.)
- Where in my liver is the cancer? Has it spread beyond my liver?
- What is my cancer's stage, and what does that mean?
- How well is my liver functioning?
- Will I need other tests before we can decide on treatment?
- Will I need to see other doctors?
- How much experience do you have treating this type of cancer?
- What are my treatment choices?

- Can the cancer be removed with surgery?
- What do you recommend and why?
- What is the goal of the treatment?
- What risks or side effects are there to the treatments you suggest?
- What should I do to be ready for treatment?
- How long will treatment last? What will it be like? Where will it be done?
- How will treatment affect my daily activities?
- What are the chances my cancer will recur with these treatment plans?
- What will we do if the treatment doesn't work or if the cancer recurs?
- What type of follow-up will I need after treatment?

In addition to these sample questions, you might want to write down some of your own. For instance, you might want to ask about second opinions or about qualifying for clinical trials.

What happens after treatment for liver cancer?

For some people with liver 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 growing or coming back. (When cancer comes back after treatment, it is called a *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 others, liver cancer may never go away completely. You may still get regular treatments 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

Even after you have completed treatment, your doctors will still need to watch you closely. It is very important to go to all follow-up appointments. During these visits, your doctors will ask about symptoms, do physical exams, and may order blood tests, such as alpha-fetoprotein

(AFP) levels, liver function tests (LFTs). Imaging tests, such as ultrasound, CT, or MRI scans might also be ordered.

If you have been treated with a surgical resection or a liver transplant and have no signs of cancer remaining, most doctors recommend follow-up with imaging tests and blood tests every 3 to 6 months for the first 2 years, then every 6 to 12 months. Follow-up is needed to check for cancer recurrence or spread, as well as possible side effects of certain treatments.

This is the time for you to ask your health care team any questions you need answered and to discuss any concerns you might have.

Almost any cancer treatment can have side effects. Some may last for a few weeks to several months, but others can last the rest of your life. 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 effectively.

It is important to keep health insurance. Health care costs a lot, and even though no one wants to think of their cancer coming back, this could happen.

If your cancer does come back, treatment will depend on the location of the cancer, what treatments you've had before, and your overall health and liver function. For more information on how recurrent cancer is treated, see the section "Treatment of liver cancer, by stage." For more general information on dealing with a recurrence, you might also want to see the American Cancer Society document *When Your Cancer Comes Back: Cancer Recurrence*. You can get this document by calling 1-800-227-2345.

Follow-up after a liver transplant

A liver transplant can be very effective at treating the cancer and replacing a damaged liver. But this is a major procedure that requires intense follow-up after treatment. Along with monitoring your recovery from surgery and looking for possible signs of cancer recurrence, your medical team will watch you closely to make sure your body is not rejecting the new liver.

You will need to take strong medicines to help prevent the rejection. These medicines can have their own side effects, including weakening your immune system, which can make you more likely to get infections.

Your transplant team should tell you what to watch for in terms of symptoms and side effects and when you need to contact them. It is very important to follow their instructions closely.

Anti-viral treatment

If you have hepatitis B or C that may have contributed to your liver cancer, your doctor may want to put you on medicines to treat or help control the infection.

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 about your medical history. It is important that you can give your new doctor the details of your diagnosis and treatment. Gathering these details soon after treatment may be easier than trying to get them at some point in the future. Make sure you have this information handy:

- A copy of your pathology report(s) from any biopsies or surgeries
- Copies of imaging tests (CT or MRI scans, etc.), which can usually be stored on a CD, DVD, etc.
- If you had surgery, a copy of your operative report(s)
- If you stayed in the hospital, a copy of the discharge summary that doctors prepare when patients are sent home
- If you had radiation therapy, a summary of the type and dose of radiation and when and where it was given
- If you had chemotherapy or targeted therapies, a list of your drugs, drug doses, and when you took them

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

Lifestyle changes after liver 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.

Make 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 might 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 at 1-800-227-2345.

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 to start healthy eating habits. 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. Get more information in our document *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

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 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 physical activity plan should fit your situation. A person who has never exercised will not be able to take on the same amount of exercise as someone 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. Get more information in our document *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

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.

Can I lower my risk of the cancer progressing or coming back?

Most people want to know if there are specific lifestyle changes they can make to reduce their risk of cancer progressing or coming back. Unfortunately, for most cancers there is little solid evidence to guide people. This doesn't mean that nothing will help – it's just that for the most part this is an area that hasn't been well studied. Most studies have looked at lifestyle changes as ways of preventing cancer in the first place, not slowing it down or preventing it from coming back.

For example, staying at a healthy weight, staying away from heavy alcohol and tobacco use, and taking steps to help prevent or treat hepatitis might all lower a person's risk of liver cancer, but it's not clear how they affect the risk of recurrence in someone who has already had the disease. Adopting healthy behaviors such as these might help, but no one knows for sure.

For cancer survivors in general, the American Cancer Society recommends staying at a healthy weight, getting regular physical activity, and eating a healthy diet that is high in vegetables, fruits, and whole grains. These types of changes can also have positive effects on your health that extend beyond your risk of cancer.

How does having liver cancer affect your emotional health?

During and after treatment, you may find yourself overcome with many different emotions. This happens to a lot of people.

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 relationships with those around you. Unexpected issues may also cause concern. For instance, you may see your health care team less often after treatment and have more time on your hands. These changes can make some people anxious.

Almost everyone who is going through or 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. You can also read our document *Distress in People with Cancer* or see the emotional side effects section of our website for more information.

What if treatment for liver cancer is no longer working?

If cancer keeps growing or comes back after one kind of treatment, it may be possible to try another treatment plan that might still cure the cancer, or at least shrink the tumors 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, including treatment side effects. 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 might 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 might say that more treatment might have about a 1 in 100 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, it is important that you 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 goal 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. You can learn more about the changes that occur when curative treatment stops working, and about planning ahead for yourself and your family, in our documents *Nearing the End of Life* and *Advance Directives*.

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 this 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 liver cancer research and treatment?

Because there are only a few effective ways to prevent or treat liver cancer at this time, there is always a great deal of research going on in the area of liver cancer. Scientists are looking for causes and ways to prevent liver cancer, and doctors are working to improve treatments.

Prevention

The most effective way to reduce the worldwide burden of liver cancer is to prevent it from happening in the first place. Some scientists believe that vaccinations and improved

treatments for hepatitis could prevent about half of liver cancer cases worldwide. Researchers are studying ways to prevent or treat hepatitis infections before they cause liver cancers. Research into developing a vaccine to prevent hepatitis C is ongoing. Progress is also being made in treating chronic hepatitis.

Screening

Several new blood tests are being studied to see if they can detect liver cancer earlier than using AFP and ultrasound. One that is promising is called DKK1.

Surgery

Newer techniques are being developed to make both partial hepatectomy and liver transplants safer and more effective.

Adding other treatments to surgery

An active area of research uses *adjuvant* therapies – treatments given right after surgery – to try to reduce the chances that the cancer will return. Most of the studies so far using chemotherapy or chemoembolization after surgery have not shown that they help people live longer. But newer drugs, may prove to be more effective. Some of the drugs being studied include the targeted drug sorafenib (Nexavar) and menatetrenone, a drug that is chemically similar to Vitamin K. Some promising results have also been seen with radioembolization, but these need to be confirmed in larger studies.

Doctors are also studying ways to make more liver cancers resectable by trying to shrink them before surgery. Studies are now looking at different types of *neoadjuvant* therapies (therapies given before surgery), including targeted therapy, chemotherapy, ablation, embolization, and radiation therapy. Early results have been promising but have only looked at small numbers of patients.

Laparoscopic surgery

In laparoscopic surgery, several small incisions are made in the abdomen, and special long, thin surgical instruments are inserted to view and cut out the diseased portion of the liver. It does not require a large incision in the abdomen, which means there is less blood loss, less pain after surgery, and a quicker recovery.

At this time, laparoscopic surgery is still considered experimental for liver cancer. It is being studied mainly in patients with small tumors in certain parts of the liver that can be easily reached through the laparoscope.

Determining recurrence risk after surgery

After a partial hepatectomy, one of the biggest concerns is that the cancer might come back (recur). Knowing someone's risk for recurrence after surgery might give doctors a better idea of how best to follow up with them, and may someday help determine who needs additional treatment to lower this risk.

Researchers may have found a way to do this by testing the cells in the surgery sample. In a recent study, they looked at the pattern of genes in liver cells near the tumor (not the tumor cells themselves) and were able to predict which patients were at higher risk for recurrence. This early finding will need to be confirmed in other studies before it is widely used.

Liver transplant

Only a small portion of patients with liver cancer are candidates for a liver transplant because of the strict criteria they need to meet (based mainly on the size and number of tumors). Some doctors are now looking to see if these criteria can be expanded, so that people who are otherwise healthy but have slightly larger tumors might also be eligible.

Radiation therapy

The main problem with using radiation therapy against liver cancer is that it also damages healthy liver tissue. Researchers are now working on ways to focus radiation therapy more narrowly on the cancer, sparing the nearby normal liver tissue. One approach being studied is called brachytherapy. In this treatment, catheters (thin tubes) are placed in the tumor and then pellets that give off radiation are put into the catheters for a short time. After the treatment, both the pellets and the catheters are removed. This allows radiation to be targeted to the cancer with less harm to the normal liver.

Targeted therapy

New drugs are being developed that work differently from standard chemotherapy drugs. These newer drugs target specific parts of cancer cells or their surrounding environments.

Tumor blood vessels are the target of several newer drugs. Liver tumors need new blood vessels to grow beyond a certain size. The drug sorafenib (Nexavar), which is already used for some liver cancers that can't be removed surgically, works in part by hindering new blood vessel growth. This drug is now being studied for use earlier in the course of the disease, such as after surgery or trans-arterial chemoembolization (TACE). Researchers are also studying whether combining it with chemotherapy may make it more effective.

Regorafenib (Stivarga[®]) is another targeted drug that is showing promise in treating liver cancers

Chemotherapy

New forms of systemic and regional chemotherapy combined with other treatments are being tested in clinical trials. A small number of tumors respond to chemotherapy, although it has not yet been shown to prolong survival.

Chemotherapy drugs, such as oxaliplatin, capecitabine, gemcitabine, and docetaxel, are being tested against liver cancer in clinical trials. Oxaliplatin has shown promising results in early studies when given in combination with doxorubicin and also when given with gemcitabine and the targeted therapy drug cetuximab (Erbix[®]).

If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our Guide to Cancer Drugs on our website, or call us with the names of the medicines you're taking.

Virus therapy

A newer approach to treatment is the use of a virus, known as *JX-594*. This started as the same virus that was used to make the smallpox vaccine, but it has been altered in the lab so that it mainly infects cancer cells and not normal cells. A solution containing the virus is injected into liver cancers, and the virus can enter the cancer cells, where it causes them to die or to make proteins that result in them being attacked by the body's immune system. Early results of this treatment against advanced liver cancer have been promising, even in patients who have already had other treatments.

Additional resources for liver 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 website, www.cancer.org.

Living with cancer

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

Nutrition for the Person With Cancer During Treatment: A Guide for Patients and Families (also in Spanish)

Living With Uncertainty: The Fear of Cancer Recurrence

When Your Cancer Comes Back: Cancer Recurrence

When Cancer Doesn't Go Away

Guide to Controlling Cancer Pain (also in Spanish)

Sexuality for the Man With Cancer (also available in Spanish)

Sexuality for the Woman With Cancer (also available in Spanish)

Understanding cancer treatments

Understanding Cancer Surgery: A Guide for Patients and Families (also in Spanish)

A Guide to Chemotherapy (also in Spanish)

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

Targeted Therapy

Cancer treatment side effects

Nausea and Vomiting

Anemia in People With Cancer

Fatigue in People With Cancer

Work, insurance, and finances

Health Insurance and Financial Assistance for the Cancer Patient

Returning to Work After Cancer Treatment

Working During Cancer Treatment

Family and caregiver concerns

Talking With Friends and Relatives About Your Cancer (also in Spanish)

What It Takes to Be a Caregiver

Helping Children When a Family Member Has Cancer: Dealing With Diagnosis (also available in Spanish)

When treatment is no longer working

Nearing the End of Life

Advance Directives

Hospice Care

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 websites*

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

American Liver Foundation

Toll-free number: 1-800-GO-LIVER (1-800-465-4837)

Website: www.liverfoundation.org

Provides free information on primary liver cancer, liver transplants, and other liver diseases. They offer support groups in some areas, and also have materials in Spanish and Chinese

National Cancer Institute

Toll-free number: 1-800-4-CANCER (1-800-422-6237)

Website: www.cancer.gov

Provides free information on all types of cancer, living with cancer, support information for families of people with cancer, research, and more

National Coalition for Cancer Survivorship

Toll-free number: 1-888-650-9127

1-877-NCCS-YES (622-7937) for some publications and Cancer Survivor Toolbox[®] orders

Website: www.canceradvocacy.org

Offers information on work, health insurance, and more. The Cancer Survival Toolbox is a free, self-learning audio program to help cancer survivors and caregivers develop practical tools needed to deal with the diagnosis, treatment and challenges of cancer. Listen online or order CDs. Also in Spanish and Chinese

Patient Advocate Foundation

Toll-free number: 1-800-532-5274

Website: www.patientadvocate.org

Helps mediate among the patient and insurer, employer, or creditors to resolve insurance, job, or debt problems related to their cancer. Helps people get access to care and keep job and financial stability

United Network for Organ Sharing

Toll-free number: 1-888-894-6361

Website: www.unos.org

Maintains international waiting lists and medical databases to help match organ donors and recipients. Offers a free publication, “The Patient Information Kit about Transplantation” (visit the UNOS Store online) and a special website on transplants at www.transplantliving.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.

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