



COLORECTAL CANCER

What is cancer?

Cancer develops when cells in a part of the body begin to grow out of control. Although there are many kinds of cancer, they all start because of out-of-control growth of abnormal cells.

Normal body cells grow, divide, and die in an orderly fashion. During the early years of a person's life, normal cells divide more rapidly until the person becomes an adult. After that, cells in most parts of the body divide only to replace worn-out or dying cells and to repair injuries.

Because cancer cells continue to grow and divide, they are different from normal cells. Instead of dying, they outlive normal cells and continue to form new abnormal cells.

Cancer cells develop because of damage to DNA. This substance is in every cell and directs all its activities. Most of the time when DNA becomes damaged the body is able to repair it. In cancer cells, the damaged DNA is not repaired. People can inherit damaged DNA, which accounts for inherited cancers. Many times though, a person's DNA becomes damaged by exposure to something in the environment, like smoking.

Cancer usually forms as a tumor. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

Often, cancer cells travel to other parts of the body, where they begin to grow and replace normal tissue. This process is called metastasis. Regardless of where a cancer may spread, however, it is always named for the place it began. For instance, breast cancer that spreads to the liver is still called breast cancer, not liver cancer.

Not all tumors are cancerous. Benign (non-cancerous) tumors do not spread (metastasize) to other parts of the body and, with very rare exceptions, are not life threatening.

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.

Cancer is the second leading cause of death in the United States. Nearly half of all men and a little over one third of all women in the United States will develop cancer during their lifetimes. Today, millions of people are living with cancer or have had cancer. The risk of developing most types of cancer can be reduced by changes in a person's lifestyle, for example, by quitting smoking and eating a better diet. The sooner a cancer is found and treatment begins, the better are the chances for living for many years.

What is colorectal cancer?

Colorectal cancer is a term used to refer to cancer that develops in the colon or the rectum. These cancers are sometimes referred to separately as colon cancer or rectal cancer, depending on where they start. Colon cancer and rectal cancer have many features in common. They are discussed together in this document except for the section about treatment, where they are discussed separately.

The normal digestive system

The colon and rectum are parts of the digestive system, which is also called the gastrointestinal (GI) system (see picture, below). The first part of digestive system processes food for energy while the last part (the colon and rectum) removes solid waste (fecal matter or stool) from the body. In order to understand colorectal cancer, it helps to have some basic knowledge about the normal structure and function of the digestive system.

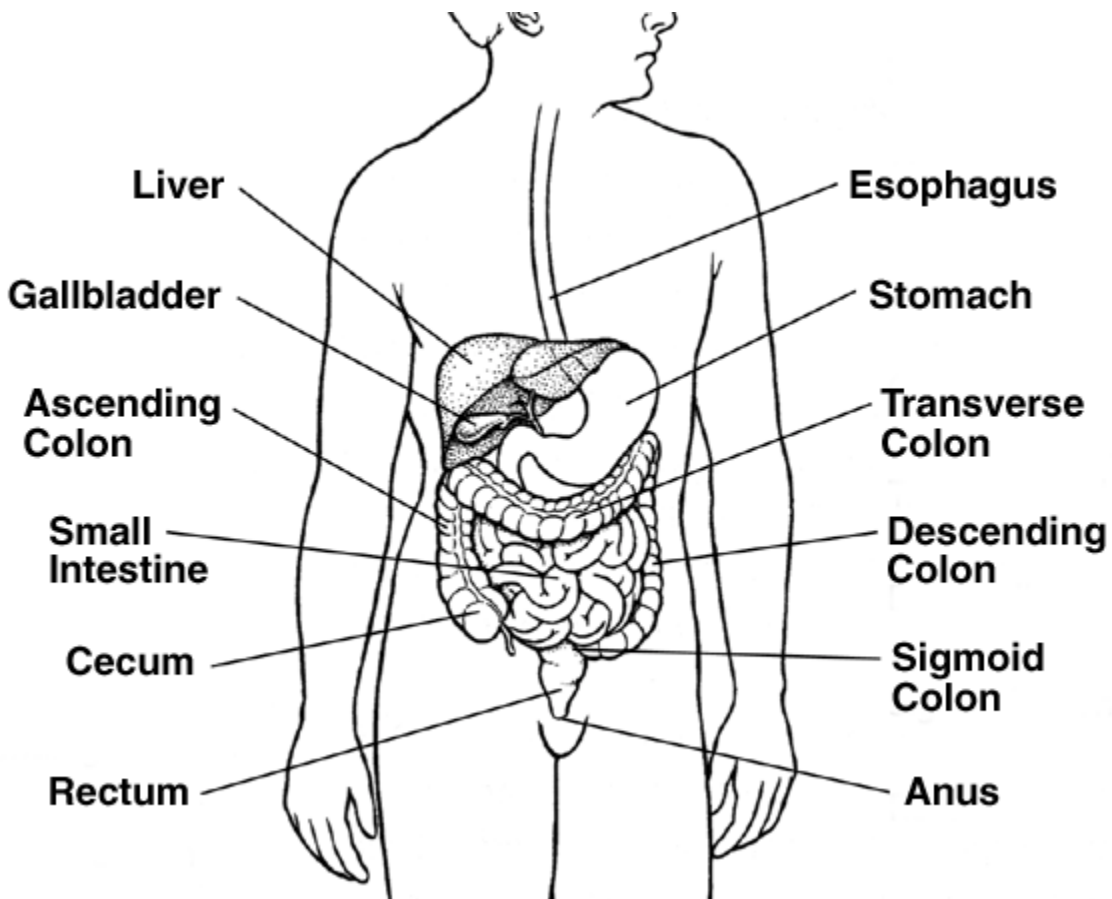
After food is chewed and swallowed, it travels through the esophagus to the stomach. There it is partly broken down and then sent to the *small intestine*, also known as the *small bowel*. The word "small" refers to the diameter of the small intestine, which is narrower than that of the large bowel (colon and rectum). Actually the small intestine is the longest segment of the digestive system -- about 20 feet. The small intestine continues breaking down the food and absorbs most of the nutrients.

The small bowel joins the *colon* in the right lower abdomen. The colon (also called the *large bowel* or *large intestine*) is a muscular tube about 5 feet long. The colon absorbs water and salt from the food matter and serves as a storage place for waste matter.

The colon has 4 sections:

- The first section is called the *ascending colon*. It starts with a small pouch (the cecum) where the small bowel attaches to the colon and extends upward on the right side of the abdomen. The cecum is also where the appendix attaches to the colon.
- The second section is called the *transverse colon* since it goes across the body from the right to the left side in the upper abdomen.
- The third section, the *descending colon*, continues downward on the left side.
- The fourth and last section is known as the *sigmoid colon* because of its "S" or "sigmoid" shape.

The waste matter that is left after going through the colon is known as feces or stool. It goes into the *rectum*, the final 6 inches of the digestive system. From there it passes out of the body through the *anus*.



The wall of the colon and rectum is made up of several layers of tissue. Colorectal cancer starts in the innermost layer and can grow through some or all of the other layers. Knowing a

little about these layers is important, because the *stage* (extent of spread) of a colorectal cancer depends to a great degree on how deeply it invades into these layers. For more information, please refer to the section "How is colorectal cancer staged?"

Abnormal growths in the colon or rectum

In most people, colorectal cancers develop slowly over a period of several years. Before a cancer develops, a growth of tissue or tumor usually begins as a non-cancerous *polyp* on the inner lining of the colon or rectum. A tumor is abnormal tissue and can be benign (not cancer) or malignant (cancer). A polyp is a benign, non-cancerous tumor. Some polyps can change into cancer but not all do. The chance of changing into a cancer depends upon the kind of polyp:

- **Adenomatous polyps (adenomas)** are polyps that have the potential to change into cancer. . Because of this, adenomas are called a pre-cancerous condition.
- **Hyperplastic polyps and inflammatory polyps**, in general, are not pre-cancerous. But some doctors think that some hyperplastic polyps can become pre-cancerous or might be a sign of having a greater risk of developing adenomas and cancer, particularly when these polyps grow in the ascending colon.

Another kind of pre-cancerous condition is called *dysplasia*. Dysplasia is an area in the lining of the colon or rectum where the cells look abnormal (but not like true cancer cells) when viewed under a microscope. These cells have the potential to change into cancer over time. This is usually seen in people who have had diseases such as ulcerative colitis or Crohns disease for many years. Both ulcerative colitis and Crohns disease cause chronic inflammation of the colon.

Start and spread of colorectal cancer

If cancer forms within a polyp, it can eventually begin to grow into the wall of the colon or rectum. When cancer cells are in the wall, they can then grow into blood vessels or lymph vessels. Lymph vessels are thin, tiny channels that carry away waste and fluid. They first drain into nearby lymph nodes, which are bean-shaped structures that help fight against infections. Once cancer cells spread into blood or lymph vessels, they can travel to distant parts of the body, such as the liver. This process of spread is called *metastasis*.

Types of cancer in the colon and rectum

Adenocarcinomas: More than 95% of colorectal cancers are a type of cancer known as *adenocarcinomas*. These are cancers that start in cells that form glands that make mucus to lubricate the inside of the colon and rectum. When doctors talk about colorectal cancer, this is almost always what they are referring to.

Other, less common types of tumors may also develop in the colon and rectum. These include:

Carcinoid tumors: These tumors develop from specialized hormone-producing cells of the intestine. They are discussed in the separate American Cancer Society document, *Gastrointestinal Carcinoid Tumors*.

Gastrointestinal stromal tumors (GISTs): These tumors develop from specialized cells in the wall of the colon called the "interstitial cells of Cajal." Some are benign (non-cancerous); others are malignant (cancerous). Although these tumors can be found anywhere in the digestive tract, they are unusual in the colon. They are discussed in the separate American Cancer Society document, *Gastrointestinal Stromal Tumors*.

Lymphomas: These are cancers of immune system cells that typically develop in lymph nodes, but they may also start in the colon and rectum or other organs. Information on lymphomas of the digestive system is included in the separate American Cancer Society document, *Non-Hodgkin Lymphoma*.

The remainder of this document focuses only on colorectal adenocarcinomas.

What are the key statistics about colorectal cancer?

Excluding skin cancers, colorectal cancer is the third most common cancer diagnosed in both men and women in the United States. The American Cancer Society estimates that about 108,070 new cases of colon cancer (53,760 in men and 54,310 in women) and 40,740 new cases of rectal cancer (23,490 in men and 17,250 in women) will be diagnosed in 2008.

Overall, the lifetime risk for developing colorectal cancer is about 1 in 19 (5.4%). This risk is slightly higher in men than in women. A number of other factors (described in "What are the risk factors for colorectal cancer?") may also affect a person's risk.

Colorectal cancer is the third leading cause of cancer-related deaths in the United States when men and women are considered separately, and the second leading cause when both sexes are combined. It is expected to cause about 49,960 deaths (24,260 men and 25,700 women) during 2008.

The death rate (the number of deaths per 100,000 people per year) from colorectal cancer has been dropping for more than 20 years. There are a number of likely reasons for this. One is that polyps are being found by screening and removed before they can develop into cancers. Screening is also allowing more colorectal cancers to be found earlier when the disease is easier to cure. In addition, treatment for colorectal cancer has improved over the last several years. As a result, there are now more than 1 million survivors of colorectal cancer in the United States.

Statistics related to survival among people with colorectal cancer are discussed in the section "How is colorectal cancer staged?"

What are the risk factors for colorectal cancer?

A risk factor is anything that affects your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer, and smoking is a risk factor for cancers of the lungs larynx, mouth, throat, esophagus, kidneys, bladder, colon and several other organs.

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

Researchers have found several risk factors that may increase a person's chance of developing colorectal polyps or colorectal cancer.

Risk factors you cannot change

Age

While younger adults can develop colorectal cancer, the chances of developing colorectal cancer increase markedly after age 50. More than 90% of people diagnosed with colorectal cancer are older than 50.

Personal history of colorectal polyps or colorectal cancer

If you have a history of adenomatous polyps (adenomas), you are at increased risk of developing colorectal cancer. This is especially true if the polyps are large or if there are many of them.

If you have had colorectal cancer, even though it has been completely removed, you are more likely to develop new cancers in other areas of the colon and rectum. The chances of this happening are greater if you had your first colorectal cancer when you were younger than age 60.

Personal history of inflammatory bowel disease

Inflammatory bowel disease (IBD), which includes *ulcerative colitis* and *Crohn's disease*, is a condition in which the colon is inflamed over a long period of time. If you have IBD, your risk of developing colorectal cancer is increased, and you need to be screened for colorectal cancer on a more frequent basis (see the section, "Can colorectal cancer be found early?"). Often the first sign that cancer may be developing is called *dysplasia*. Dysplasia is a term that refers to abnormal cells that have the potential to progress to cancer.

Inflammatory bowel disease is different than *irritable bowel syndrome (IBS)*, which does not carry an increased risk for colorectal cancer.

Family history of colorectal cancer

Most colorectal cancers occur in people without a family history of colorectal cancer. Still, up to 20% of people who develop colorectal cancer have other family members who have been affected by this disease.

People with a history of colorectal cancer or adenomatous polyps in one or more first-degree relatives (parents, siblings, children) are at increased risk. The risk is about doubled in those with a single affected first-degree relative, and is even higher in people with a stronger family history, such as:

- a history of colorectal cancer or adenomatous polyps in any first-degree relative (parent, sibling, or child) younger than age 60
- a history of colorectal cancer or adenomatous polyps in 2 or more first-degree relatives at any age

The reasons for the increased risk are not clear in all cases. Cancers can "run in the family" because of inherited genes, shared environmental factors, or some combination of these.

People diagnosed with adenomatous polyps or colorectal cancer should inform other family members. Those with a family history of colorectal cancer need to talk with their doctor about the possible need to begin screening before age 50.

Inherited syndromes

About 5% of people who develop colorectal cancer have an inherited genetic susceptibility to the disease. The 2 most common inherited syndromes linked with colorectal cancers are familial adenomatous polyposis (FAP) and hereditary non-polyposis colorectal cancer (HNPCC).

Familial adenomatous polyposis (FAP): FAP is caused by changes (mutations) in the APC gene that a person inherits from his or her parents. About 1% of all colorectal cancers are due to FAP.

People with this disease typically develop hundreds or thousands of polyps in their colon and rectum, usually in their teens or early adulthood. Cancer usually develops in 1 or more of these polyps as early as age 20. By age 40, almost all people with this disorder will have developed cancer if preventive surgery (removing the colon) is not done.

FAP is sometimes associated with Gardner syndrome, a condition that involves benign (non-cancerous) tumors of the skin, soft connective tissue, and bones.

Hereditary non-polyposis colon cancer (HNPCC): HNPCC, also known as Lynch syndrome, is another clearly defined genetic syndrome. It accounts for about 3% to 4% of all colorectal cancers. HNPCC can be caused by inherited changes in a number of different genes that normally help repair DNA damage. (See the section, "Do we know what causes colorectal cancer?" for more details.)

This syndrome also develops when people are relatively young. People with HNPCC have polyps, but they only have a few, not hundreds as in FAP. The lifetime risk of colorectal cancer in people with this condition may be as high as 70% to 80%.

Women with this condition also have a very high risk of developing cancer of the endometrium (lining of the uterus). Other cancers linked with HNPCC include cancer of the ovary, stomach, small bowel, pancreas, kidney, ureters (tubes that carry urine from the kidneys to the bladder), and bile duct.

For more information on HNPCC, see the sections "Do we know what causes colorectal cancer?" and "Can colorectal cancer be prevented?"

Peutz-Jeghers syndrome: People with this rare inherited condition tend to have freckles around the mouth (and sometimes on the hands and feet) and large polyps in their digestive

tracts. They are at greatly increased risk for colorectal cancer, as well as several other cancers, which usually appear at a younger than normal age.

Identifying families with these inherited syndromes is important because it allows doctors to recommend specific steps, such as screening and other preventive measures, at an early age.

Because several types of cancer can be linked with these syndromes, people should check their family medical history for polyps or any type of cancer. Those who develop polyps or cancer should inform other family members. People with a family history of colorectal polyps or cancer should consider genetic counseling to review their family medical tree and determine whether genetic testing may be right for them. If needed, this can help them to decide about getting screened and treated at an early age. More information on genetic counseling and testing can be found in the section "Can colorectal cancer be prevented?"

Racial and ethnic background

African Americans have the highest colorectal cancer incidence and mortality rates of all racial groups in the United States. The reason for this is not yet understood.

Jews of Eastern European descent (Ashkenazi Jews) have one of the highest colorectal cancer risks of any ethnic group in the world. Several gene mutations leading to an increased risk of colorectal cancer have been found in this group. The most common of these DNA changes, called the I1307K APC mutation, is present in about 6% of American Jews.

Lifestyle-related factors

Several lifestyle-related factors have been linked to colorectal cancer. In fact, the links between diet, weight, and exercise and colorectal cancer risk are some of the strongest for any type of cancer.

Certain types of diets

A diet that is high in red meats (beef, lamb, or liver) and processed meats (hot dogs, bologna, and luncheon meat) can increase colorectal cancer risk. Methods of cooking meats at very high temperatures (frying, broiling, or grilling) create chemicals that might increase cancer risk, although it's not clear how much this might contribute to an increase in colorectal cancer risk. Diets high in vegetables and fruits have been linked with a decreased risk of colorectal cancer. Whether other dietary components (fiber, certain types of fats, etc.) affect colorectal cancer risk is not clear.

Physical inactivity

If you are not physically active, you have a greater chance of developing colorectal cancer. Increasing activity may help reduce your risk.

Obesity

If you are very overweight, your risk of developing and dying from colorectal cancer is increased. While obesity raises the risk of colon cancer in both men and women, the link seems to be stronger in men.

Smoking

Long-term smokers are more likely than non-smokers to develop and die from colorectal cancer. While smoking is a well-known cause of lung cancer, some of the cancer-causing substances are swallowed and can cause digestive system cancers, such as colorectal cancer.

Heavy alcohol use

Colorectal cancer has been linked to the heavy use of alcohol. At least some of this may be due to the fact that heavy alcohol users tend to have low levels of folic acid in the body. Still, alcohol use should be limited to no more than 2 drinks a day for men and 1 drink a day for women.

Type 2 diabetes

People with type 2 (usually non-insulin dependent) diabetes have an increased risk of developing colorectal cancer. Both type 2 diabetes and colorectal cancer share some of the same risk factors (such as excess weight). But even after taking these into account, people with type 2 diabetes still have an increased risk. They also tend to have a less favorable prognosis (outlook) after diagnosis.

Factors with uncertain, controversial, or unproven effects on colorectal cancer

Night shift work

Results of one study suggested working a night shift at least 3 nights a month for at least 15 years may increase the risk of colorectal cancer in women. The study authors suggested this might be due to changes in levels of melatonin (a hormone that responds to changes in light) in the body. More research is needed to confirm or refute this finding.

Previous treatment for certain cancers

Some studies have found that men who survive testicular cancer seem to have a higher rate of colorectal cancer and some other cancers. This might be due to the treatments they have received.

Some early studies suggested that men who received radiation therapy to treat prostate cancer might have a higher risk of rectal cancer, as the rectum receives some radiation during treatment. However, other studies have not found such a link.

The American Cancer Society and several other medical organizations recommend earlier screening for people with increased colorectal cancer risk. These recommendations differ from those for people at average risk. For more information, speak with your doctor and refer to the table in the "Can colorectal polyps and cancer be found early?" section of this document.

Do we know what causes colorectal cancer?

Although we do not know the exact cause of most colorectal cancers, there is a great deal of research in this area.

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

Some genes contain instructions for controlling when our cells grow, divide, and die. Certain genes that speed up cell division are called *oncogenes*. Others that slow down cell division, or cause cells to die at the right time, are called *tumor suppressor genes*. Cancers can be

caused by DNA mutations (changes) that "turn on" oncogenes or "turn off" tumor suppressor genes. Changes in several different genes seem to be needed to cause colorectal cancer.

DNA mutations may be passed on from generation to generation. When this happens, we say the mutations are inherited. Other mutations happen during an individual's lifetime and are not passed on. These DNA changes are called acquired mutations. These are the most common type of mutations. Some of the same genes are involved in both hereditary and acquired mutations.

Inherited gene mutations

A small percentage of colorectal cancers are known to be caused by inherited gene mutations. Many of these DNA changes and how they can change the growth control of cells are now known.

Inherited changes in a gene called *APC*, for example, are responsible for *familial adenomatous polyposis (FAP)* and *Gardner syndrome*. The *APC* gene is a tumor suppressor gene -- it normally helps keep cell growth in check. In people who have inherited changes in the *APC* gene, this "brake" on cell growth is turned off, resulting in the formation of hundreds of polyps in the colon. Over time, cancer will nearly always develop in one or more of these polyps because new gene mutations occur in the cells of the polyps.

Hereditary nonpolyposis colon cancer (HNPCC), also known as Lynch syndrome, is caused by changes in genes that normally help a cell repair faulty DNA. Cells must make a new copy of their DNA each time they divide. Sometimes errors are made when copying the DNA code. Fortunately, cells have DNA repair enzymes that act like proofreaders or spell checkers. Mutations in DNA repair enzyme genes such as *MLH1*, *MSH2*, *MSH6*, or *PMS2* allow DNA errors to go uncorrected. These errors will sometimes affect growth-regulating genes, which may lead to the development of cancer.

The rare *Peutz-Jeghers syndrome* is caused by inherited changes in the *STK11* gene. This seems to be a tumor suppressor gene, although its exact function is not clear.

Genetic tests are available that can detect gene mutations associated with these inherited syndromes. As mentioned in "What are the risk factors for colorectal cancer?", people with a family history of colorectal polyps or cancer or other symptoms linked to these syndromes may want to ask their doctor about genetic counseling and genetic testing. The American Cancer Society recommends discussing genetic testing with a qualified genetic counselor before genetic testing is done.

Acquired gene mutations

In most cases of colorectal cancer, the DNA mutations that lead to cancer are acquired during a person's life rather than having been inherited. While certain risk factors likely play a role in causing these acquired mutations, so far the cause of most of these mutations remains unknown.

There does not seem to be a single pathway to colorectal cancer that is the same in all cases. In many cases, the first mutation occurs in the APC gene. This leads to an increased growth of colorectal cells because of the loss of this "brake" on cell growth. Further mutations may then occur in genes such as K-Ras, p53, and SMAD4. These changes can lead the cells to grow and spread uncontrollably. Other, as of yet unknown, genes are likely involved as well.

Can colorectal cancer be prevented?

Even though we do not know the exact cause of most colorectal cancers, it is possible to prevent many colorectal cancers.

Screening

Regular colorectal cancer screening or testing is one of the most powerful weapons in preventing colorectal cancer. From the time the first abnormal cells start to grow, it usually takes about 10 to 15 years for them to develop into colorectal cancer. Regular colorectal cancer screening can, in many cases, prevent colorectal cancer altogether. This is because some polyps, or growths, can be found and removed before they have the chance to turn into cancer. Screening can also result in finding colorectal cancer early, when it is highly curable.

People who have no identified risk factors (other than age) should begin regular screening at age 50. Those who have a family history or other risk factors for colorectal polyps or cancer, such as inflammatory bowel disease, should talk with their doctor about starting screening at a younger age and/or getting screened at more frequent intervals. (See the American Cancer Society screening guidelines in the next section, "Can colorectal polyps and cancer be found early?")

Genetic testing, screening, and treatment for those with a strong family history

People with a strong family history of colorectal polyps or cancer should consider genetic counseling to review their family medical tree and determine whether genetic testing may be right for them. If needed, this can help them to decide about getting screened and treated at an early age.

Before getting genetic testing, it's important to know ahead of time what the results may or may not tell you about your risk. Genetic testing is not perfect, and in some cases the tests may not be able to provide solid answers. This is why meeting with a genetic counselor before testing is crucial in deciding whether or not testing should be done.

Genetic tests can help determine if members of certain families have inherited a high risk for developing colorectal cancer due to syndromes such as familial adenomatous polyposis (FAP) or hereditary non-polyposis colorectal cancer (HNPCC). Without genetic testing, all members of a family known to have an inherited form of colorectal cancer should be screened early and frequently. If genetic testing is done for a known mutation within a family, those members who are found not to have inherited the mutated gene may be able to be screened with the same frequency as people at average risk.

When looking at whether testing might be appropriate, a genetic counselor will try to get a detailed view of your family history. For example, doctors have found that many families with HNPCC tend to have certain characteristics:

- at least 3 relatives have colorectal cancer
- one should be a first-degree relative (parent, sibling, or child) of the other 2 relatives
- at least 2 successive generations are involved
- at least 1 relative had their cancer when they were younger than age 50

These are called the *Amsterdam criteria*. If these hold true for your family, then you might want to seek genetic counseling. But even if your family history satisfies the Amsterdam criteria, it doesn't always mean you have HNPCC. Only about half of families who meet the Amsterdam criteria have HNPCC. The other half do not, and although their colorectal cancer rate is about twice as high as normal, it is not as high as that of people with HNPCC. On the other hand, many families with HNPCC do not meet the Amsterdam criteria.

A second set of criteria, called the *revised Bethesda guidelines*, are used to determine whether a person with colorectal cancer should have his or her cancer tested for genetic changes that are seen with HNPCC. These criteria include at least one of the following:

- The person is younger than 50 years.
- The person has or had a second colorectal cancer or another cancer (endometrial, stomach, pancreas, small intestine, ovary, kidney or ureters, bile duct) that is associated with HNPCC.
- The person is younger than 60 years and the cancer has certain characteristics seen with HNPCC when viewed under the microscope or with other lab tests.

- The person has a first-degree relative younger than 50 who was diagnosed with colorectal cancer or another cancer often seen in HNPCC carriers (endometrial, stomach, pancreas, small intestine, ovary, kidney, ureters, or bile duct).
- The person has 2 or more first- or second-degree relatives who had colorectal cancer or an HNPCC-related cancer at any age.

If a person with colorectal cancer has any of the Bethesda criteria, genetic testing is advised to look for an inherited HNPCC-associated gene mutation. Still, most people who meet the Bethesda criteria do not have HNPCC.

Not all families with HNPCC meet the criteria above. Doctors should be suspicious of HNPCC in families with colorectal cancer and other cancers associated with this syndrome, including endometrial cancers, ovarian cancers, small bowel cancers, pancreas cancers, or cancer of the lining of the kidney or the ureters.

The lifetime risk of developing colorectal cancer for people with HNPCC may be as high as 80%. In families known to carry an HNPCC gene mutation, doctors recommend that family members who have tested positive for the mutation and those who have not been tested should start colonoscopy screening during their early 20s to remove any polyps and find any cancers at the earliest possible stage (see the section, "Can colorectal polyps or cancer be found early?"). People known to carry one of the gene mutations may also be offered the option of removal of most of the colon.

Genetic counseling and testing is also available for those at risk of FAP. Their lifetime risk of developing colorectal cancer is near 100%, and in most cases it develops before the age of 40. People who test positive for the gene change linked to FAP should start colonoscopy during their teens (see the section, "Can colorectal polyps or cancer be found early?"). Most doctors recommend they have their colon removed when they are in their 20s to prevent cancer from developing.

Diet, exercise, and body weight

People can lower their risk of developing colorectal cancer by managing the risk factors that they can control, such as diet and physical activity.

Diets high in vegetables and fruits have been linked with lower risk of colon cancer, and diets high in processed and/or red meats have been linked with a higher risk. The American Cancer Society recommends the following:

- Eat a healthy diet, with an emphasis on plant sources.
- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.

- Eat 5 or more servings of a variety of vegetables and fruits each day.
- Choose whole grains rather than processed (refined) grains.
- Limit consumption of processed and red meats

Physical activity is another area that people can control. The American Cancer Society recommends at least 30 minutes, preferably 45 to 60 minutes, of physical activity on 5 or more days of the week. Taking part in moderate or vigorous activity for 45 minutes on 5 or more days of the week may lower your risk for colorectal cancer even more.

Obesity raises the risk of colon cancer in both men and women, but the link seems to be stronger in men. The American Cancer Society recommends that people try to maintain a healthy weight throughout life by balancing what they eat with physical activity. If you are overweight, you can ask your doctor about a weight loss plan that will work for you.

For more information about diet and physical activity, refer to the separate document, *American Cancer Society Guidelines for Nutrition and Physical Activity for Cancer Prevention*.

Vitamins, calcium, magnesium

Some studies suggest that taking a daily multi-vitamin containing folic acid, or folate, may lower colorectal cancer risk, but not all studies have found this. More research is needed in this area.

Some studies have suggested that vitamin D, which you can get from sun exposure or in a vitamin pill, can lower colorectal cancer risk. Because of concerns that excessive sun exposure can cause skin cancer, most experts do not recommend this as a way to lower colorectal cancer risk at this time.

Other studies suggest that increasing calcium intake may lower colorectal cancer risk. Calcium is important for a number of health reasons aside from possible effects on cancer risk. However, because of the possible increased risk of prostate cancer with high calcium intake, it may be wise for men to limit their daily calcium intake to less than 1500 mg per day until further studies are done.

Calcium and vitamin D may work together to reduce colorectal cancer risk, as vitamin D aids in the body's absorption of calcium. Still, not all studies have found these supplements to reduce risk.

A few studies have looked at a possible link between a diet high in magnesium and reduced colorectal cancer risk. Some, but not all, of these studies have found a link, especially among women. More research is needed to determine if this link exists.

Non-steroidal anti-inflammatory drugs

Many studies have found that people who regularly use aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen (Motrin, Advil) and naproxen (Aleve), have a lower risk of colorectal cancer and adenomatous polyps. Most of these studies looked at people who took these medicines for reasons such as to treat arthritis or prevent heart attacks. Other, stronger studies have provided evidence that aspirin can prevent the growth of polyps in people who were previously treated for early stages of colorectal cancer or who previously had polyps removed.

But NSAIDs can cause serious or even life-threatening bleeding from stomach irritation, which may outweigh the benefits of these medicines for the general public. For this reason, experts do not recommend NSAIDs as a cancer prevention strategy for people at average risk of developing colorectal cancer.

The value of these drugs for people at increased colorectal cancer risk is being actively studied. Celecoxib (Celebrex) has been approved by the US Food and Drug Administration for reducing polyp formation in people with familial adenomatous polyposis (FAP). While this drug may cause less bleeding in the stomach than other NSAIDs, it may increase the risk of heart attacks and strokes. A similar drug, rofecoxib (Vioxx), was taken off the market because people who took it had an increased number of heart attacks and strokes.

Because aspirin or other NSAIDs can have serious side effects, check with your doctor before starting to take any of them on a regular basis.

Female hormones

Hormone replacement therapy (HRT) consisting of estrogen and progesterone may reduce the risk of developing colorectal cancer in postmenopausal women, although cancers found in women on HRT may be at a more advanced stage.

HRT also lowers the risk of developing osteoporosis (bone thinning). But it can also increase some risks, including those of heart disease, blood clots, and breast and uterine cancers.

The decision whether or not to use HRT should be based on a careful discussion of the possible benefits and risks with your doctor.

Can colorectal polyps and cancer be found early?

This section begins with a discussion of the tests that can be used to look for colorectal polyps and cancer. This is followed by a discussion of current American Cancer Society screening guidelines for colorectal cancer.

Colorectal cancer screening tests

Screening is the process of looking for cancer in people who have no symptoms of the disease. There are several different tests that can be used to screen for colorectal cancers. These tests can be divided into 2 broad groups:

- **Tests that can find both colorectal polyps and cancer:** These tests look at the structure of the colon itself to find any abnormal areas. This is done either with a scope inserted into the rectum or with special imaging (x-ray) tests. Polyps found before they turn cancerous can be removed, so these tests may prevent colorectal cancer. Because of this, they are preferred if they are available and you are willing to have them.
- **Tests that mainly find cancer:** These involve testing the stool (feces) for signs that cancer may be present. These tests are less invasive and easier to have done, but they are less likely to detect polyps.

These tests as well as others can also be used when people have symptoms of colorectal cancer and other digestive diseases.

Tests that can find both colorectal polyps and cancer

Flexible sigmoidoscopy

During this test, the doctor looks at part of the colon and rectum with a sigmoidoscope -- a flexible, lighted tube about the thickness of a finger with a small video camera on the end. It is inserted through the rectum and into the lower part of the colon. Images from the scope are viewed on a display monitor.

Using the sigmoidoscope, your doctor can view the inside of the rectum and part of the colon to detect (and possibly remove) any abnormality. Because the sigmoidoscope is only 60 centimeters (about 2 feet) long, the doctor is able to see the entire rectum but less than half of the colon with this procedure.

Before the test: You will need to have a bowel preparation to clean out your lower colon. The colon and rectum must be empty and clean so your doctor can view the lining of the

sigmoid colon and rectum. Your doctor will give you specific instructions to follow. You may be asked to follow a special diet (such as drinking only clear liquids) for a day before the exam. You may also be asked to use enemas or to drink a strong laxative solution to clean out your colon before the exam.

During the test: A sigmoidoscopy usually takes 10 to 20 minutes. Most people do not need to be sedated for this test, but this may be an option you can discuss with your doctor. While sedation may make the test less uncomfortable, it requires having someone with you to take you home after the test. You will likely be placed on a table on your left side with your knees positioned near your chest.

Your doctor should do a digital rectal exam (DRE) before inserting the sigmoidoscope. The sigmoidoscope is lubricated so it is easy to insert into the rectum. The scope may feel cool going in. The sigmoidoscope may stretch the wall of the colon, which may cause muscle spasms or lower abdominal pain. Air will be placed into the sigmoid colon through the sigmoidoscope so the doctor can see the colon better. During the procedure, you might feel pressure and slight cramping in your lower abdomen. To ease discomfort and the urge to have a bowel movement, it helps to breathe deeply and slowly through your mouth. You will feel better after the test once the air leaves your colon.

If a small polyp is found during the test your doctor may remove it with a small instrument passed through the scope. The polyp will be sent to a lab to be looked at by a pathologist. If a pre-cancerous polyp (an adenoma) or colorectal cancer is found during the test, you will need to have a colonoscopy at a later date to look for polyps or cancer in the rest of the colon.

Possible complications and side effects: This test may be uncomfortable because of the air put into the colon, but it should not be painful. Be sure to let your doctor know if you feel pain during the procedure. You may see a small amount of blood in your first bowel movement after the test. Significant bleeding and puncture of the colon are possible complications, but they are very uncommon.

Colonoscopy

For this test, the doctor looks at the entire length of the colon and rectum with a colonoscope, which is basically a longer version of a sigmoidoscope. It is inserted through the rectum into the colon. The colonoscope has a video camera on the end that is connected to a display monitor so the doctor can see and closely examine the inside of the colon. Special instruments can be passed through the colonoscope to remove any suspicious looking areas such as polyps, if needed.

Colonoscopy may be done in a hospital outpatient department, in a clinic, or in a doctor's office.

Before the test: The colon and rectum must be empty and clean so your doctor can view their inner linings during the test. You will need to take laxatives (liquids, pills, or both) the day before the test and possibly an enema that morning. Your doctor will give you specific instructions. It is important to read these carefully a few days ahead of time, since you may need to shop for special supplies and get laxatives from a pharmacy. If you are not sure about any of the instructions, call the doctor's office and go over them step by step with the nurse. Many people consider the bowel preparation to be the most unpleasant part of the test, as it usually requires you to be in the bathroom quite a bit.

You may be given other instructions as well. For example, your doctor may instruct that you drink only clear liquids (water, apple or cranberry juice, and any gelatin except red or purple) for a day or 2 before the exam. Plain tea or coffee with sugar is usually okay, but no milk or creamer is allowed. Clear broth, ginger ale, and most soft drinks or sports drinks are usually allowed unless they have red or purple food colorings, which can discolor the colon.

You will likely also be told not to eat or drink anything after midnight the night before your test. If you normally take prescription medicines in the mornings, talk with your doctor or nurse about how to manage them for the day.

You may need to arrange for someone to drive you home from the test because the sedative used during the test can affect your ability to drive. Depending on the medicines that are used, some doctors require that someone drive you home.

During the test: The test itself usually takes about 30 minutes, although it may take longer if a polyp is found and removed. Before the colonoscopy begins, you will be given a sedating medicine through your vein to make you feel comfortable and sleepy during the procedure. You will probably be awake, but you may not be aware of what is going on and may not remember the procedure afterward. Most people will be fully awake by the time they get home from the test.

During the procedure, you will be placed on your side with your knees flexed and a drape will cover you. Your blood pressure, heart rate, and breathing rate will be monitored during and after the test.

Your doctor should do a digital rectal exam (DRE) before inserting the colonoscope. The colonoscope is lubricated so it can be easily inserted into the rectum. Once in the rectum, the colonoscope is passed through the transverse colon and into the ascending colon. You may feel an urge to have a bowel movement when the colonoscope is inserted or pushed further up the colon. To ease any discomfort it may help to breathe deeply and slowly through your mouth. The colonoscope will deliver air into the colon so that it is easier to see the lining of the colon and use the instruments to perform the test. Suction will be used to remove any blood or liquid stools.

If a small polyp is found, the doctor may remove it. Some small polyps may eventually become cancerous. For this reason, they are usually removed. This is done by passing a wire

loop through the colonoscope to cut the polyp from the wall of the colon with an electrical current. The polyp can then be sent to a lab to be checked under a microscope to see if it has any areas that have changed into cancer.

If your doctor sees a large polyp or tumor or anything else abnormal, a biopsy may be done. For this procedure, a small piece of tissue is taken out through the colonoscope. The tissue is looked at under a microscope to determine if it is a cancer, a benign (non-cancerous) growth, or a result of inflammation.

Possible side effects and complications: The bowel preparation before the test can be unpleasant. The test itself may be uncomfortable, but the sedative usually prevents this, and most people feel normal once the effects of the sedative wear off. Some people may have gas pains or cramping for a while after the test.

In some cases, people may have low blood pressure or changes in heart rhythms due to the sedation during the test, although these are rarely serious.

If a polyp is removed or a biopsy is done during the colonoscopy, you may notice some blood in your stool for a day or 2 after the test. Significant bleeding is slightly more likely with colonoscopy than with sigmoidoscopy, but it is still uncommon. In rare cases, continued bleeding might require treatment.

Although colonoscopy is a safe procedure, on rare occasions the colonoscope can puncture the wall of the colon or rectum. This is called a perforation. It can be a serious complication and at times requires surgical repair. Talk to your doctor about the risk of this complication.

Double contrast barium enema (DCBE)

This procedure is also called an *air-contrast barium enema* or a *barium enema with air contrast*. It is basically a type of x-ray test. Barium sulfate, which is a chalky liquid, and air are used to outline the inner part of the colon and rectum to look for abnormal areas on x-rays. If suspicious areas are seen on this test, a colonoscopy will be needed to explore them further.

Before the test: As with colonoscopy, it is very important that the colon and rectum are empty and clean so your doctor can view them during the test. Your doctor will give you specific instructions on preparing for the test. Be sure to follow them. For example, you may be asked to clean your bowel the night before with laxatives and/or take an enema the morning of the exam. You will likely be asked to follow a clear liquid diet for a day or 2 before the procedure. You may also be told to avoid eating or drinking dairy products the day before the test, and to not eat or drink anything after midnight on the night before the procedure. Many people consider the bowel preparation to be the most unpleasant part of the test, as it usually requires you to be in the bathroom quite a bit.

During the test: The procedure takes about 30 to 45 minutes to perform, and it does not require sedation. For this test, you lie on a table on your side in an x-ray room. A small, flexible tube is inserted into the rectum, and barium sulfate is used to partially fill and open up the colon. When the colon is about half-full of barium, you are turned on the x-ray table so the barium spreads throughout the colon. Then air is pumped into the colon through the same tube to make it expand. This may cause some discomfort, and you may feel the urge to have a bowel movement.

X-ray pictures of the lining of your colon are then taken, allowing the doctor to identify any polyps or cancers. You may be asked to change positions so that different views of the colon and rectum can be seen on the x-rays.

If polyps or other suspicious areas are seen on this test, a colonoscopy will likely be needed to remove them or to explore them fully.

Possible side effects and complications: You may have bloating or cramping after the test, and will likely feel the need to empty your bowels almost immediately after the test is done. The barium can cause constipation for a few days, and your stool may appear grey or white until the barium leaves the body. There is a very small risk that inflating the colon with air could injure or puncture the colon, but this risk is thought to be much less than with colonoscopy.

CT colonography (virtual colonoscopy)

This test is an advanced type of computed tomography (CT or CAT) scan of the colon and rectum. A CT scan is an x-ray test that produces detailed cross-sectional images of your body. Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer then combines these pictures into images of slices of the part of your body being studied. CT colonography involves the use of special computer programs to create both two dimensional x-ray pictures and a three-dimensional "fly-through" view of the inside of the colon and rectum, which allows the doctor to look for polyps or cancer.

This test may be especially useful for some people who can't have or don't want to have more invasive tests such as colonoscopy. It can be done fairly quickly and does not require sedation. But while this test is not invasive like colonoscopy, it still requires the same type of bowel preparation. If polyps or other suspicious areas are seen on this test, a colonoscopy will likely be needed to remove them or to explore them fully.

Before the test: It is important that the colon and rectum are emptied before this test to provide the best images. Because of this, the preparation for this test is similar to that for a double contrast barium enema or colonoscopy. You will likely be told to follow a clear liquid

diet for a day or 2 before the test. You will also be given instructions for taking strong laxatives and/or enemas the night before or morning of the exam. This will likely require you to be in the bathroom quite a bit.

During the test: This test is done in a special room with a CT scanner, and takes about 10 minutes. You may be asked to drink a contrast solution before the test to help "tag" any remaining stool in the colon or rectum, which helps the doctor when looking at the test images. You will be asked to lie in a thin table that is part of the CT scanner, and will have a small, flexible tube inserted into your rectum. Air is pumped through the tube into the colon to expand it to provide better images. The table then slides into the CT scanner, and you will be asked to hold your breath while the scan takes place. You will likely have 2 scans: one while you are lying on your back and one while you are on your stomach. Each scan typically takes only about 10 to 15 seconds.

Possible side effects and complications: There are usually very few side effects after CT colonography. You may feel bloated or have cramps due to the air in the colon, but this should go away once the air passes from the body. There is a very small risk that inflating the colon with air could injure or puncture the colon, but this risk is thought to be much less than with colonoscopy.

Tests that mainly find colorectal cancer

These tests examine the stool to look for signs of cancer. Most people find these tests to be easier because they are not invasive and can often be done at home. But they are not as good at detecting polyps as the tests described above, and a positive result on one of these screening tests will likely require a more invasive test such as colonoscopy.

Fecal occult blood test

The fecal occult blood test (FOBT) is used to find occult (hidden) blood in feces. The idea behind this test is that blood vessels at the surface of larger colorectal polyps or cancers are often fragile and easily damaged by the passage of feces. The damaged vessels usually release a small amount of blood into the feces, but only rarely is there enough bleeding to be noticeable in the stool.

The FOBT detects blood in the stool through a chemical reaction. This test cannot tell whether the blood is from the colon or from other portions of the digestive tract (such as the stomach). Therefore, if this test is positive, a colonoscopy is needed to see if there is a cancer, polyp, or other cause of bleeding such as ulcers, hemorrhoids, diverticulosis (tiny pouches that form at weak spots in the colon wall), or inflammatory bowel disease (colitis).

This is a take-home kit that is used in the privacy of your own home. *An FOBT done during a digital rectal exam in the doctor's office is not sufficient for screening.* In order to be beneficial the test must be repeated every year.

People having this test will receive a kit with instructions from their doctor's office or clinic. The kit will explain how to take a stool or feces sample at home (usually specimens from 3 consecutive bowel movements that are smeared onto small squares of paper). The kit should then be returned to the doctor's office or medical lab (usually within 2 weeks) for testing. See below for more details.

Before the test: Some foods or drugs can affect the test, so your doctor may suggest that you try to avoid the following before this test:

- non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen (Advil), naproxen (Aleve), or aspirin (more than 1 adult aspirin per day), for 7 days before testing (they can cause bleeding, which can lead to a false-positive result). Acetaminophen (Tylenol) can be taken as needed.
- vitamin C in excess of 250 mg daily from either supplements or citrus fruits and juices for 3 days before testing (this can affect the chemicals in the test and make it show negative)
- red meats (beef, lamb, or liver) for 3 days before testing (components of blood in the meat may cause the test to show positive)

Some people who are given the test never do it or don't give it to their doctor because they worry that something they ate may interfere with the test. For this reason, many doctors tell their patients it isn't essential to follow any restrictions in their diet. The most important thing is to get the test done. People should try to avoid taking aspirin or related drugs for minor aches. But if you take these medicines daily for heart problems or other conditions, don't stop them for this test without approval from your doctor.

Collecting the samples: Have all of your supplies ready and in one place. Supplies will include a test kit, test cards, either a brush or wooden applicator, and a mailing envelope. The kit will give you detailed instructions on how to collect the specimen. The instructions below can be used as a guide, but your kit instructions might be a little different. Always follow the instructions on your kit.

- You will need to collect a sample from your bowel movement. You can place a sheet of plastic wrap across the toilet bowl to catch the stool or you can use a dry container to collect the stool. Do not let the stool specimen mix with urine. After you obtain a sample, you can flush the remaining stool down the toilet.
- Use a wooden applicator or a brush to smear a thin film of the stool sample onto one of the slots in the test card or slide.

- Next, collect a specimen from a different area of the same stool and smear a thin film of the sample onto the other slot in the test card or slide.
- Close the slots and put your name and the date on the test kit. Store the kit overnight in a paper envelope to allow it time to dry.
- Repeat the test on your next 2 bowel movements if instructed. Most tests require collecting more than one sample from different bowel movements. This improves the accuracy of the test because many cancers bleed intermittently and blood may not be present in all stool samples.
- Place the test kit in the mailing pouch provided and return it to your doctor or lab as soon as possible (but within 14 days of taking the first sample).

If this test finds blood, a colonoscopy will be needed to look for the source. It is not sufficient to simply repeat the FOBT or follow up with other types of tests.

Fecal immunochemical test

The fecal immunochemical test (FIT), also called an immunochemical fecal occult blood test (iFOBT), is a newer kind of test that also detects occult (hidden) blood in the stool. This test reacts to part of the hemoglobin molecule, which is found on red blood cells.

The FIT is done essentially the same way as the FOBT, but some people may find it easier to use because there are no drug or dietary restrictions (vitamins or foods do not affect the FIT) and sample collection may take less effort. This test is also less likely to react to bleeding from the upper digestive tract, such as the stomach.

As with the FOBT, the FIT may not detect a tumor that is not bleeding, so multiple stool samples should be tested. And if the results are positive for hidden blood, a colonoscopy is required to investigate further. In order to be beneficial the test must be repeated every year.

Collecting the samples: Have all of your supplies ready and in one place. Supplies will include a test kit, test cards, long brushes, waste bags, and a mailing envelope. The kit will give you detailed instructions on how to collect the specimen. The instructions below can be used as a guide, but your kit instructions might be a little different. Always follow the instructions on your kit.

- Flush the toilet before your bowel movement. After you go, place used toilet paper in the waste bag from the kit, not in the toilet.

- Brush the surface of the stool with one of the brushes, then dip the brush in the toilet water. Dab the end of the brush onto one of the slots in the test card or slide.
- Close the slot and put your name and the date on the test kit.
- Repeat the test on your next bowel movement if instructed. Most tests require collecting more than one sample from different bowel movements. This improves the accuracy of the test because many cancers bleed intermittently and blood may not be present in all stool samples.
- Place the test kit in the mailing envelope provided and return it to your doctor or lab as soon as possible (but within 14 days of taking the first sample).

Stool DNA tests

Instead of looking for blood in the stool, these tests look for certain abnormal sections of DNA (genetic material) from cancer or polyp cells. Colorectal cancer cells often contain DNA mutations (changes) in certain genes such as APC, K-ras, and p53. Cells from colorectal cancers or polyps with these mutations are often shed into the stool, where tests may be able to detect them.

This is a newer test, and the best length of time to go between tests is not yet clear. This test is also much more expensive than other forms of stool testing.

This test is not invasive and doesn't require any special preparation. But as with other stool tests, if the results are positive, a colonoscopy is required to investigate further.

People having this test will receive a kit with detailed instructions from their doctor's office or clinic on how to collect the specimen. Always follow the instructions on your kit.

This test requires an entire stool sample. It is obtained using a special container, which is placed in a bracket that stretches across the seat of the toilet. You have your bowel movement while sitting on the toilet, making sure it goes into the container. You then place the container and an ice pack in a shipping box and close and label the box. The specimen must be shipped to the lab within 24 hours of having the bowel movement.

What are some of the pros and cons of these screening tests?

Test	Pros	Cons
Flexible sigmoidoscopy	Fairly quick and safe Minimal bowel preparation Sedation usually not used Does not require a specialist Done every 5 years	Views only about a third of the colon Can't remove all polyps May be some discomfort Done in a doctor's office, clinic, or hospital Very small risk of bleeding, infection, or bowel tear Colonoscopy will be needed if abnormal
Colonoscopy	Can usually view entire colon Can biopsy and remove polyps Done every 10 years Can diagnose other diseases	Can miss small polyps Full bowel preparation needed More expensive on a one-time basis than other forms of testing Sedation of some kind is usually needed Will need someone to drive you home You may miss a day of work Small risk of bleeding, bowel tears, or infection
Double contrast barium enema (DCBE)	Can usually view entire colon Relatively safe Done every 5 years No sedation needed	Can miss small polyps Full bowel preparation needed Some false positive test results Cannot remove polyps during testing Colonoscopy will be needed if abnormal
CT colonography (virtual colonoscopy)	Fairly quick and safe Can usually view entire colon Done every 5 years No sedation needed	Can miss small polyps Full bowel preparation needed Some false positive test results Cannot remove polyps during testing Colonoscopy will be needed if abnormal Still fairly new - may be insurance issues
Fecal occult blood test (FOBT)	No direct risk to the colon No bowel preparation Sampling done at home Inexpensive	May miss many polyps and some cancers May produce false-positive test results May have pre-test dietary limitations Should be done annually Colonoscopy will be needed if abnormal
Fecal immunochemical test (FIT)	No direct risk to the colon No bowel preparation No pre-test dietary restrictions Sampling done at home Fairly inexpensive	May miss many polyps and some cancers May produce false-positive test results Should be done annually Colonoscopy will be needed if abnormal
Stool DNA test	No direct risk to the colon No bowel preparation No pre-test dietary restrictions Sampling done at home	May miss many polyps and some cancers May produce false-positive test results More expensive than other stool tests Still a fairly new test Not clear how often it should be done Colonoscopy will be needed if abnormal

American Cancer Society recommendations for colorectal cancer early detection

People at average risk

The American Cancer Society believes that preventing colorectal cancer (and not just finding it early) should be a major reason for getting tested. Finding and removing polyps keeps some people from getting colorectal cancer. Tests that have the best chance of finding both polyps and cancer are preferred if these tests are available to you and you are willing to have them.

Beginning at age 50, both men and women at *average risk* for developing colorectal cancer should use one of the screening tests below:

Tests that find polyps and cancer

- flexible sigmoidoscopy every 5 years*
- colonoscopy every 10 years
- double contrast barium enema every 5 years*
- CT colonography (virtual colonoscopy) every 5 years*

Tests that mainly find cancer

- fecal occult blood test (FOBT) every year*,**
- fecal immunochemical test (FIT) every year*,**
- stool DNA test (sDNA), interval uncertain*

*Colonoscopy should be done if test results are positive.

**For FOBT or FIT used as a screening test, the take-home multiple sample method should be used. A FOBT or FIT done during a digital rectal exam in the doctor's office is not adequate for screening.

In a *digital rectal examination (DRE)*, a doctor examines your rectum with a lubricated, gloved finger. Although a DRE is often included as part of a routine physical exam, it is not recommended as a stand-alone test for colorectal cancer. This simple test, which is not usually painful, can detect masses in the anal canal or lower rectum. By itself, however, it is not a very sensitive test for detecting colorectal cancer due to its limited reach.

Doctors often find a small amount of stool when doing a DRE. However, simply checking stool obtained in this fashion for evidence of bleeding with a FOBT or FIT is not an

acceptable method of screening for colorectal cancer. Research has shown that this type of stool examination will miss more than 90% of colon abnormalities, including most cancers.

People at increased or high risk

If you are at an increased risk or higher than average risk of colorectal cancer, you should begin colorectal cancer screening earlier and/or be screened more often. The following conditions place you at higher than average risk:

- a personal history of colorectal cancer or adenomatous polyps
- a personal history of inflammatory bowel disease (ulcerative colitis or Crohn's disease)
- a strong family history of colorectal cancer or polyps (see "Risk factors for colorectal cancer" above)
- a known family history of hereditary colorectal cancer syndromes such as familial adenomatous polyposis (FAP) or hereditary non-polyposis colon cancer (HNPCC)

The table below suggests screening guidelines for those with *increased or high risk* of colorectal cancer based on specific risk factors. Some people may have more than one risk factor. Refer to the table below and discuss these recommendations with your doctor. Based on your individual situation and any risk factors you may have, your doctor can suggest the best screening option for you, as well as any changes in the schedule based on your individual risk.

American Cancer Society Guidelines on Screening and Surveillance for the Early Detection of Colorectal Adenomas and Cancer in People at Increased Risk or at High Risk			
Risk Category	Age to Begin	Recommended Test(s)	Comment
INCREASED RISK – Patients With a History of Polyps on Prior Colonoscopy			
People with small rectal hyperplastic polyps	Same as those at average risk	Colonoscopy, or other screening options at same intervals as for those at average risk	Those with hyperplastic polyposis syndrome are at increased risk for adenomatous polyps and cancer and should have more intensive follow-up.
People with 1 or 2 small (less than 1 cm) tubular adenomas with low-grade dysplasia	5 to 10 years after the polyps are removed	Colonoscopy	Time between tests should be based on other factors such as prior colonoscopy findings, family history, and patient and doctor preferences.
People with 3 to 10 adenomas, or a large (1 cm +) adenoma, or any adenomas with high-grade dysplasia or villous features	3 years after the polyps are removed	Colonoscopy	Adenomas must have been completely removed. If colonoscopy is normal or shows only 1 or 2 small tubular adenomas with low-grade dysplasia, future colonoscopies can be done every 5 years.
People with more than 10	Within 3 years after the	Colonoscopy	Doctor should consider possibility of

adenomas on a single exam	polyps are removed		genetic syndrome (such as FAP or HNPCC).
People with sessile adenomas that are removed in pieces	2 to 6 months after adenoma removal	Colonoscopy	If entire adenoma has been removed, further testing should be based on doctor's judgment
INCREASED RISK – Patients With Colorectal Cancer			
People diagnosed with colon or rectal cancer	At time of colorectal surgery, or can be 3 to 6 months later if person doesn't have cancer spread that can't be removed	Colonoscopy to view entire colon and remove all polyps	If the tumor presses on the colon/rectum and prevents colonoscopy, CT colonoscopy (with IV contrast) or DCBE may be done to look at the rest of the colon.
People who have had colon or rectal cancer removed by surgery	Within 1 year after cancer resection (or 1 year after colonoscopy to make sure the rest of the colon/rectum was clear)	Colonoscopy	If normal, repeat exam in 3 years. If normal then, repeat exam every 5 years. Time between tests may be shorter if polyps are found or there is reason to suspect HNPCC. After low anterior resection for rectal cancer, exams of the rectum may be done every 3 to 6 months for the first 2 to 3 years to look for signs of recurrence.
INCREASED RISK – Patients With a Family History			
Colorectal cancer or adenomatous polyps in any first-degree relative before age 60, or in 2 or more first-degree relatives at any age (if not a hereditary syndrome).	Age 40, or 10 years before the youngest case in the immediate family, whichever is earlier	Colonoscopy	Every 5 years.
Colorectal cancer or adenomatous polyps in any first-degree relative aged 60 or higher, or in at least 2 second-degree relatives at any age	Age 40	Same options as for those at average risk.	Same intervals as for those at average risk.
HIGH RISK			
Familial adenomatous polyposis (FAP) diagnosed by genetic testing, or suspected FAP without genetic testing	Age 10 to 12	Yearly flexible sigmoidoscopy to look for signs of FAP; counseling to consider genetic testing if it hasn't been done	If genetic test is positive, removal of colon (colectomy) should be considered.
Hereditary non-polyposis colon cancer (HNPCC), or at increased risk of HNPCC based on family history without genetic testing	Age 20 to 25 years, or 10 years before the youngest case in the immediate family	Colonoscopy every 1 to 2 years; counseling to consider genetic testing if it hasn't been done	Genetic testing should be offered to first-degree relatives of people found to have HNPCC mutations by genetic tests. It should also be offered if 1 of the first 3 of the modified Bethesda criteria is met. ¹
Inflammatory bowel disease -Chronic ulcerative colitis -Crohn's disease	Cancer risk begins to be significant 8 years after the onset of pancolitis (involvement of entire large intestine), or 12-15	Colonoscopy every 1 to 2 years with biopsies for dysplasia	These people are best referred to a center with experience in the surveillance and management of inflammatory bowel disease.

	years after the onset of left-sided colitis		
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The Bethesda criteria can be found in the "Can colorectal cancer be prevented?" section of this document.

Insurance coverage for colorectal cancer screening

Despite the availability of effective colorectal cancer screening tests, not enough people have them. Some factors affecting their use could include lack of public and health professional awareness of screening tools, financial barriers, and inadequate health insurance coverage and/or benefits.

Laws regarding insurance coverage for colorectal cancer screening tests vary by state. The same is true of state Medicaid programs. For people with Medicare, coverage begins at age 50 for the most common colorectal cancer screening tests.

For more information on insurance coverage for colorectal cancer screening tests, please see the separate American Cancer Society document, *Colorectal Cancer: Early Detection*.

How is colorectal cancer diagnosed?

While colorectal cancer is often found after symptoms appear, most people with early colon or rectal cancer have no symptoms of the disease. Symptoms usually appear only with more advanced disease. This is why getting the recommended screening tests (as described in "Can colorectal polyps and cancer be found early?") before any symptoms develop is so important.

If your doctor finds something suspicious during a screening exam, or if you have any of the symptoms of colorectal cancer described below, you will likely need to undergo a diagnostic workup.

Signs and symptoms of colorectal cancer

If you have any of the following you should check with your doctor for prompt diagnosis and treatment:

- a change in bowel habits, such as diarrhea, constipation, or narrowing of the stool, that lasts for more than a few days
- a feeling that you need to have a bowel movement that is not relieved by doing so
- rectal bleeding, dark stools, or blood in the stool (often, though, the stool will look normal)

- cramping or abdominal (stomach area) pain
- weakness and fatigue

Most of these symptoms are more likely to be caused by conditions other than colorectal cancer, such as infection, hemorrhoids, or inflammatory bowel disease. 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.

Whether you are undergoing diagnosis because of the results of a screening exam or because you have symptoms, your doctor may perform the following:

Medical history and physical exam

If you have any signs or symptoms that suggest you might have colorectal cancer, your doctor will want to take a complete medical history to check for symptoms and risk factors, including your family history.

As part of a physical exam, your doctor will carefully feel your abdomen for masses or enlarged organs, and also examine the rest of your body. Your doctor may also perform a digital rectal exam (DRE). During this test, the doctor inserts a lubricated, gloved finger into the rectum to feel for any abnormal areas.

Blood tests

Your doctor may also order certain blood tests to help determine if you have colorectal cancer.

Complete blood count (CBC): Your doctor may order a complete blood count to see if you have anemia (too few red blood cells). Some people with colorectal cancer become anemic because of prolonged bleeding from the tumor. You may also have a blood test of your liver function, because colorectal cancer can spread to the liver and cause abnormalities.

Tumor markers: Colorectal cancer sometimes produces substances, such as carcinoembryonic antigen (CEA) and CA 19-9, that are released into the bloodstream. Blood tests for these "tumor markers" are used most often with other tests for follow-up of patients who already have been treated for colorectal cancer. They may provide an early warning of a cancer that has returned.

These tumor markers are not used to find cancer in people who have never had a cancer and appear to be healthy because the tests are not always accurate. Tumor marker levels can be normal in a person who has cancer and can be abnormal for reasons other than cancer. For

example, higher levels may also be present in the blood of some people with ulcerative colitis, non-cancerous tumors of the intestines, or some types of liver disease or chronic lung disease. Smoking can also raise CEA levels.

Tests to look for colorectal polyps or cancer

If symptoms or the results of the physical exam or blood tests suggest that colorectal cancer might be present, your doctor may recommend one or more additional tests. This might include endoscopic tests such as sigmoidoscopy or colonoscopy, or imaging tests such as a barium enema (lower GI series), double-contrast barium enema, or CT colonography (virtual colonoscopy). Most of these tests are described in detail in the section "Can colorectal polyps or cancer be found early?"

Biopsy: Usually if a suspected colorectal cancer is found by any diagnostic test, it is biopsied during a colonoscopy. In a biopsy, the doctor removes a small piece of tissue with a special instrument passed through the scope. Although there may be some bleeding afterward, this usually stops after a short time.

The biopsy specimen is sent to the lab where a pathologist, a doctor trained to diagnose cancer and other diseases in tissue samples, looks at the tissue under a microscope. While other tests may suggest that colorectal cancer is present, a biopsy is the only way to determine this for certain.

Imaging tests

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

Computed tomography (CT or CAT) scan

The CT scan is an x-ray test that produces detailed cross-sectional images of your body. Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer then combines these pictures into images of slices of the part of your body being studied. Unlike a regular x-ray, a CT scan creates detailed images of the soft tissues in the body. This test can help tell if colon cancer has spread into your liver or other organs.

After the first set of pictures is taken you may be asked to drink a contrast solution and/or receive an IV (intravenous) line through which a contrast dye is injected. This helps better outline structures in your body. A second set of pictures is then taken.

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

CT scans take longer than regular x-rays. You need to lie still on a table while they are being done. During the test, the table moves in and out of the scanner, a ring-shaped machine that completely surrounds the table. You might feel a bit confined by the ring you have to lie in while the pictures are being taken.

In recent years, *spiral CT* (also known as helical CT) has become available in many medical centers. This type of CT scan uses a faster machine. The scanner part of the machine rotates around the body continuously, allowing doctors to collect the images much more quickly than with standard CT. This lowers the chance of "blurred" images occurring as a result of breathing motion. It also lowers the dose of radiation received during the test. The biggest advantage may be that the "slices" it images are thinner, which yields more detailed pictures and allows doctors to look at suspicious areas from different angles.

For spiral CT with *portography* (looking at the portal vein -- the large vein leading into the liver from the intestine), contrast material is injected into veins that lead to the liver, to help find metastases from colorectal cancer to that organ.

CT-guided needle biopsy: CT scans can also be used to precisely guide a biopsy needle into a suspected tumor or metastasis. For this procedure, the patient remains on the CT scanning table, while a radiologist advances a biopsy needle through the skin and toward the location of the mass. CT scans are repeated until the doctors are confident that the needle is within the mass. A fine-needle biopsy sample (tiny fragment of tissue) or a core needle biopsy sample (a thin cylinder of tissue about ½ inch long and less than 1/8 inch in diameter) is then removed and looked at under a microscope.

CT colonography (virtual colonoscopy): CT scans can also be used to perform a "virtual colonoscopy." This test requires the same type of preparation (cleansing of stool from the colon) as is needed before colonoscopy. Before the scan is done, the colon is inflated with air so that it can be viewed more clearly; this stretches the colon and can cause some discomfort.

Spiral CT of the abdomen is then done. The thin images it obtains can be combined to create two- and three-dimensional views of the colon and rectum. If abnormalities are detected, a follow-up colonoscopy will be needed to take tissue samples of the abnormal areas.

Ultrasound

Ultrasound involves the use of sound waves and their echoes to produce a picture of internal organs or masses. A small microphone-like instrument called a *transducer* emits sound waves and picks up the echoes as they bounce off body tissues. The echoes are converted by a computer into a black and white image that is displayed on a computer screen. This test is painless and does not expose you to radiation.

Abdominal ultrasound can be used to look for tumors in your liver, gallbladder, pancreas, or even inside your abdomen, although it can't look for tumors of the colon. When you have an abdominal ultrasound exam, you simply lie on a table and a technician moves the transducer over the skin overlying the part of your body being examined. Usually, the skin is first lubricated with gel.

Two special types of ultrasound exams can be used to evaluate people with colon and rectal cancer.

Endorectal ultrasound uses a special transducer that can be inserted directly into the rectum. This test is used to see how far through the wall a rectal cancer may have penetrated and whether it has spread to nearby organs or tissues such as lymph nodes.

Intraoperative ultrasound is done after the surgeon has opened the abdominal cavity. The transducer can be placed against the surface of the liver, making this test very useful in detecting metastases of colorectal cancer to the liver.

Magnetic resonance imaging (MRI) scan

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. A contrast material called gadolinium is often injected into a vein before the scan to better see details.

MRI scans are a little more uncomfortable than CT scans. First, they take longer -- often up to an hour. Second, you have to lie inside a narrow tube, which is confining and can upset people with claustrophobia (a fear of enclosed spaces). Newer, "open" MRI machines can sometimes help with this if needed. The machine also makes buzzing and clicking noises that you may find disturbing. Some centers provide headphones with music to block this out.

MRI scans are sometimes useful in looking at abnormal areas in the liver that might be due to cancer spread. They can also help determine the extent of rectal cancers. To improve the accuracy of the test, some doctors use *endorectal MRI*. For this test the doctor places a probe,

called an endorectal coil, inside the rectum. This must stay in place for 30 to 45 minutes and can be uncomfortable.

Chest X-ray

This test may be done after colorectal cancer has been diagnosed to determine whether it has spread to the lungs.

Positron emission tomography (PET) scan

PET scans involve injecting a form of radioactive sugar (known as fluorodeoxyglucose or FDG) into the blood. The amount of radioactivity used is very low. Because cancer cells in the body are growing rapidly, they absorb large amounts of the radioactive sugar. A special camera can then create a picture of areas of radioactivity in the body. The picture is not finely detailed like a CT or MRI scan, but it provides helpful information about your whole body.

PET scans are sometimes useful if your doctor thinks the cancer may have spread (or returned after treatment) but doesn't know where. PET scans can be used instead of several different x-rays because they scan your whole body.

Some newer machines are able to perform both a PET and CT scan at the same time (PET/CT scan). This allows the radiologist to compare areas of higher radioactivity on the PET with the appearance of that area on the CT.

Angiography

This test is sometimes used to help plan surgery, especially for tumors in the liver. For an angiogram, a doctor inserts a very thin tube (called a catheter) into an artery, usually on the inner thigh. The catheter is threaded through the artery until the tip is near the liver. Contrast dye is then injected rapidly and a series of x-rays is taken. This can show surgeons the location of blood vessels next to any tumors in the liver, so that they can be removed without causing a lot of bleeding.

How is colorectal cancer staged?

The *stage* describes the extent of the cancer in the body. It is based on how far the cancer has grown into the wall of the intestine, whether or not it has reached nearby structures, and

whether or not it has spread to the lymph nodes or distant organs. The stage of a cancer is one of the most important factors in determining prognosis and treatment options.

Staging is the process of finding out how far a cancer has spread. It is based on the results of the physical exam, biopsies, and imaging tests (CT or MRI scan, x-rays, PET scan, etc.), which are described in the section "How is colorectal cancer diagnosed?", as well as the results of surgery.

There are actually 2 types of staging for colorectal cancer. The *clinical stage* is your doctor's best estimate of the extent of your disease, based on the results of the physical exam, biopsy, and any imaging studies you have had. If you have surgery, your doctors can also determine the *pathologic stage*, which is based on the same factors as the clinical stage, plus what is found during surgery and examination of the removed tissue with a microscope. Because most patients with colorectal cancer have surgery, the pathologic stage is most often used when describing the extent of this cancer. Pathologic staging is likely to be more accurate than clinical staging, as it allows your doctor to get a firsthand impression of the extent of your disease.

AJCC (TNM) Staging System

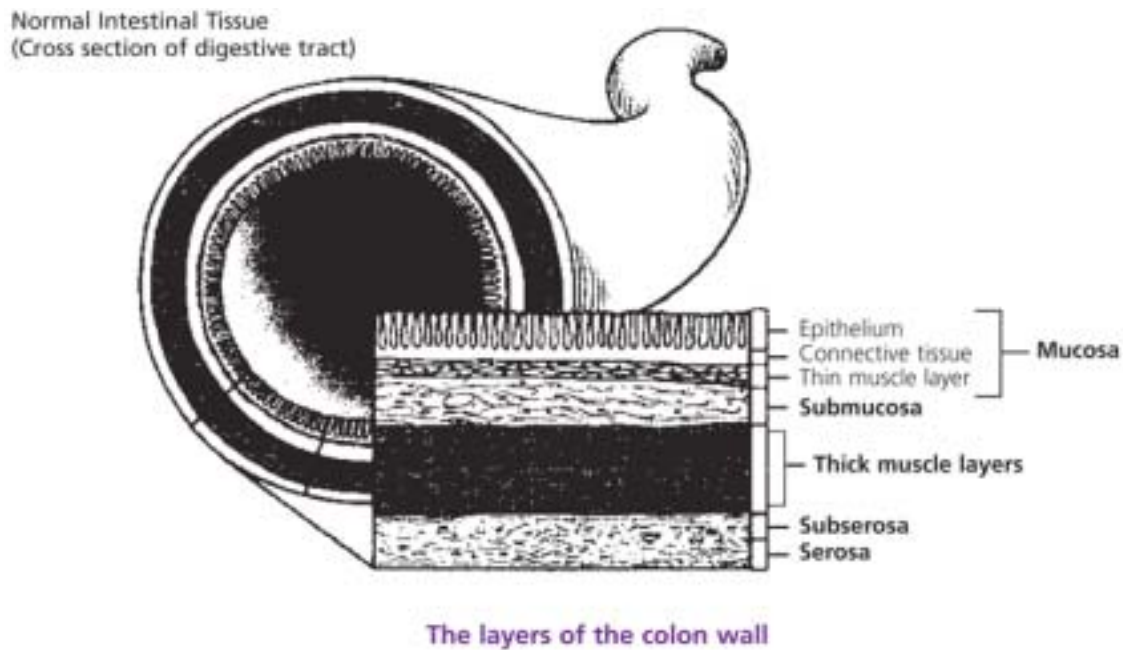
A *staging system* is a standardized way in which the cancer care team describes the extent of the cancer. The most commonly used staging system for colorectal cancer is that of the American Joint Committee on Cancer (AJCC), sometimes also known as the TNM system. Older systems, such as the Dukes and Astler-Coller system, are mentioned briefly below for comparison. The TNM system describes 3 key pieces of information:

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

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

T categories for colorectal cancer

T categories of colorectal cancer describe the extent of spread through the layers that form the wall of the colon and rectum.



These layers, from the inner to the outer, include:

- the inner lining (*mucosa*)
- a thin muscle layer (*muscularis mucosa*)
- the fibrous tissue beneath this muscle layer (*submucosa*)
- a thick muscle layer (*muscularis propria*) that contracts to force the contents of the intestines along
- the thin, outermost layers of connective tissue (*subserosa and serosa*) that cover most of the colon but not the rectum

Tx: No description of the tumor's extent is possible because of incomplete information.

Tis: The cancer is in the earliest stage. It involves only the mucosa. It has not grown beyond the muscularis mucosa (inner muscle layer).

T1: The cancer has grown through the muscularis mucosa and extends into the submucosa.

T2: The cancer has grown through the submucosa and extends into the muscularis propria (outer muscle layer).

T3: The cancer has grown through the muscularis propria and into the subserosa but not to any neighboring organs or tissues.

T4: The cancer has grown through the wall of the colon or rectum and into nearby tissues or organs.

N categories for colorectal cancer

N categories indicate whether or not the cancer has spread to nearby lymph nodes and, if so, how many lymph nodes are involved.

Nx: No description of lymph node involvement is possible because of incomplete information.

N0: No lymph node involvement is found.

N1: Cancer cells found in 1 to 3 nearby lymph nodes.

N2: Cancer cells found in 4 or more nearby lymph nodes.

M categories for colorectal cancer

M categories indicate whether or not the cancer has spread to distant organs, such as the liver, lungs, or distant lymph nodes.

Mx: No description of distant spread is possible because of incomplete information.

M0: No distant spread is seen.

M1: Distant spread is present.

Stage grouping

Once a person's T, N, and M categories have been determined, usually after surgery, this information is combined in a process called *stage grouping*. The stage is expressed in Roman numerals from stage I (the least advanced) to stage IV (the most advanced). Some stages are subdivided with letters. The following guide illustrates how TNM categories are grouped together into stages:

Stage 0

Tis, N0, M0: The cancer is in the earliest stage. It has not grown beyond the inner layer (mucosa) of the colon or rectum. This stage is also known as *carcinoma in situ* or *intramucosal carcinoma*.

Stage I

T1, N0, M0 or T2, N0, M0: The cancer has grown through the muscularis mucosa into the submucosa (T1) *or* it may also have grown into the muscularis propria (T2). It has not spread to nearby lymph nodes or distant sites.

Stage IIA

T3, N0, M0: The cancer has grown into the outermost layers of the colon or rectum but has not reached nearby organs. It has not yet spread to the nearby lymph nodes or distant sites.

Stage IIB

T4, N0, M0: The cancer has grown through the wall of the colon or rectum and into other nearby tissues or organs. It has not yet spread to the nearby lymph nodes or distant sites.

Stage IIIA

T1, N1, M0 or T2, N1, M0: The cancer has grown through the mucosa into the submucosa (T1) *or* it may also have grown into the muscularis propria (T2). It has spread to 1 to 3 nearby lymph nodes but not to distant sites.

Stage IIIB

T3, N1, M0 or T4, N1, M0: The cancer has grown into the outermost layers of the colon or rectum but has not reached nearby organs (T3) *or* the cancer has grown through the wall of the colon or rectum and into other nearby tissues or organs (T4). It has spread to 1 to 3 nearby lymph nodes but not distant sites.

Stage III C

Any T, N2, M0: The cancer may or may not have grown through the wall of the colon or rectum, but it has spread to 4 or more nearby lymph nodes. It has not spread to distant sites.

Stage IV

Any T, Any N, M1: The cancer may or may not have grown through the wall of the colon or rectum, and it may or may not have spread to nearby lymph nodes. It has spread to distant sites such as the liver, lung, peritoneum (the membrane lining the abdominal cavity), or ovary.

Comparison of AJCC, Dukes, and Astler-Coller stages

If your stage is reported in letters rather than numbers, your doctor is likely referring to one of the other staging systems sometimes used for colorectal cancer. This table can be used to find the matching AJCC/TNM stage. As you can see, the Dukes and Astler-Coller staging systems often combine different AJCC stage groupings and are not as precise.

AJCC/TNM	Dukes	Astler-Coller
0	-	-
I	A	A, B1
IIA	B	B2
IIB	B	B3
IIIA	C	C1
IIIB	C	C2, C3
IIIC	C	C1, C2, C3
IV	-	D

If you have any questions about your stage, please ask your doctor to explain the extent of your disease.

Survival rates for colorectal cancer by stage

Survival rates are a way for doctors to discuss and compare the prognosis (outlook) for patients, based on the stage of the cancer or other traits. There are some important points to note about these numbers:

- The *5-year survival rate* refers to the percentage of patients who live *at least 5 years* after being diagnosed. Many of these patients live much longer than 5 years after diagnosis.
- While these numbers are among the most current we have available, they represent people who were first diagnosed and treated many years ago. Several improvements in treating colorectal cancer have been made since then, and the survival rates for people now being diagnosed with these cancers may be higher.
- While survival statistics can sometimes be useful as a general guide, they may not accurately represent any one person's prognosis. A number of other factors, including other tumor characteristics and a person's age and general health, can also affect outlook. Your doctor is likely to be a good source as to whether these numbers may apply to you, as he or she is familiar with the aspects of your particular situation.

Survival rates for colon cancer by stage

The numbers below come from a study of the National Cancer Institute's SEER database, looking at nearly 120,000 people diagnosed with colon cancer between 1991 and 2000

Stage	5-year Survival Rate
I	93%
IIA	85%
IIB	72%
IIIA	83%*
IIIB	64%
IIIC	44%
IV	8%

*In this study, survival was better for stage IIIA than for stage IIB. The reasons for this are not clear, and it is not known if this is still the case.

Relative survival rates for rectal cancer by stage

Accurate survival statistics for rectal cancer are a little harder to find, as it is a less common disease. The numbers below come from a study of the National Cancer Institute's SEER database, looking at people diagnosed with rectal cancer between 1990 and 1999.

These numbers are *relative* survival rates. A standard 5-year survival rate refers to the percentage of patients who live at least 5 years after their cancer is diagnosed; it includes people with rectal cancer who may die of other causes, such as heart disease. Five-year *relative* survival rates are adjusted for patients dying of other diseases, so they reflect the

chances of not dying specifically from rectal cancer. As with standard survival rates, these rates are based on patients diagnosed and treated more than 5 years ago; improvements in treatment since then may result in a better outlook for recently diagnosed patients.

Stage	Relative 5-year Survival Rate
I	92%
II	73%
III	56%
IV	8%

Grade of colorectal cancer

Another factor that can affect the outlook for survival is the grade of the cancer. Grade is a description of how closely the cancer resembles normal colorectal tissue when looked at under a microscope.

The scale used for grading colorectal cancers goes from G1 (where the cancer looks much like normal colorectal tissue) to G4 (where the cancer looks very abnormal). The grades G2 and G3 fall somewhere in between. The grade is often simplified as either "low-grade" (G1 or G2) or "high-grade" (G3 or G4).

Most of the time, the outlook is not as good for high-grade cancers as it is for low-grade cancers. Doctors sometimes use this distinction to decide whether a patient should get extra treatment (adjuvant therapy) with chemotherapy after surgery (discussed in more detail in the section, "Chemotherapy").

How is colorectal cancer treated?

This information represents the views of the doctors and nurses serving on the American Cancer Society's Cancer Information Database Editorial Board. These views are based on their interpretation of studies published in medical journals, as well as their own professional experience.

The treatment information in this document is not official policy of the Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor.

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

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

Making treatment decisions

The main types of treatment for colon cancer and rectal cancer are:

- surgery
- radiation therapy
- chemotherapy
- targeted therapies

Depending on the stage of the cancer, 2 or more of these types of treatment may be combined at the same time or used after one another.

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

In considering your treatment options it is often a good idea to seek a second opinion, if possible. This may provide you with more information and help you feel more confident about the treatment plan you have chosen. It is also important to know that your chances for having the best possible outcome are highest in the hands of a medical team that is experienced in treating colorectal cancer.

Surgery

The types of surgery used to treat colon and rectal cancers are slightly different and are described separately.

Colon surgery

Surgery is often the main treatment for earlier stage colon cancers.

Colectomy: A colectomy (sometimes called a hemicolectomy or segmental resection) involves removing part of the colon, as well as nearby lymph nodes.

Prior to surgery, you will need to make sure your bowels are completely empty. This is done with a bowel preparation, which may consist of laxatives and enemas. Just before the

surgery, you will be given general anesthesia, which puts you into a deep sleep. During the surgery, your surgeon will make an incision in your abdomen. He or she will remove the cancer and a small segment of normal colon on either side of your cancer. Usually, about one fourth to one third of your colon is removed, but more or less tissue may be removed depending on the exact size and location of your cancer. The remaining sections of your colon are then reattached. Nearby lymph nodes are removed at this time as well. Most experts feel that taking out as many nearby lymph nodes as possible is important, but at least 12 should be removed.

When you wake up after surgery, you will have some pain and will need to be given pain medicines for 2 or 3 days. For the first couple of days, you will be given intravenous (IV) fluids and will not be able to eat, as the colon needs some time to recover. But a colon resection rarely causes any major problems with digestive functions, and you should be able to eat in a few days (starting with clear liquids).

If the tumor is large and has blocked your colon, it may be possible to use a colonoscope to put a stent (a hollow metal or plastic tube) inside the colon to relieve the blockage and help prepare for surgery a few days later.

If a stent cannot be placed or if the tumor has caused a hole in the colon, a temporary colostomy may be needed. This involves the same type of surgery as above, but instead of reconnecting the segments of the colon, the end of the colon is attached to an opening (stoma) in the abdomen for the purpose of getting rid of body wastes. A removable collecting bag is then connected to the stoma to hold the waste. Once you are healthier, another operation (known as a colostomy reversal) can be done to attach the ends of the colon back together. Rarely, if a tumor can't be removed or a stent placed, a permanent colostomy may be needed. For more information on colostomies, refer to the separate American Cancer Society document, *Colostomy: A Guide*.

Laparoscopic-assisted colectomy: This is a newer approach to removing part of the colon and nearby lymph nodes that may be an option for some earlier stage cancers. Instead of making one long incision in the abdomen, the surgeon makes several smaller incisions. Special long instruments are inserted through these incisions to remove part of the colon and lymph nodes. One of the instruments has a small video camera on the end, which allows the surgeon to see inside the abdomen. Once the diseased part of the colon has been freed, one of the incisions is made larger to allow for its removal.

Because the incisions are smaller than with a standard colectomy, they usually heal faster. Patients may recover slightly faster and have less pain than they do after standard colon surgery.

Laparoscopic-assisted surgery appears to be about as likely to be curative as the standard approach for earlier stage cancers. But the surgery requires special expertise. If you are considering this approach, be sure to look for a skilled surgeon who has done a lot of these operations.

Polypectomy and local excision: Some early colon cancers (stage 0 and some early stage I tumors) or polyps can be removed by surgery through a colonoscope. When this is done, the surgeon does not have to cut into the abdomen. For a polypectomy, the cancer is cut out across the base of the polyp's stalk, the area that resembles the stem of a mushroom. Local excision removes superficial cancers and a small amount of nearby tissue.

Rectal surgery

Surgery is usually the main treatment for rectal cancer, although radiation and chemotherapy will often be given before or after surgery. Several surgical methods are used for removing or destroying rectal cancers.

Polypectomy and local excision: These procedures, described in the colon surgery section, can be used to remove superficial cancers or polyps. They are done with instruments inserted through the anus, without making a surgical opening in the skin of the abdomen.

Local transanal resection (full thickness resection): As with polypectomy and local excision, local transanal resection is done with instruments inserted through the anus, without making an opening in the skin of the abdomen. This operation involves cutting through all layers of the rectum to remove invasive cancer as well as some surrounding normal rectal tissue. This procedure can be used to remove some stage I rectal cancers that are relatively small and not too far from the anus.

Low anterior resection: Some stage I rectal cancers and most stage II or III cancers in the upper two thirds of the rectum (close to where it connects with the colon) can be removed by low anterior resection. In this procedure the tumor is removed without affecting the anus. After low anterior resection, your colon will be attached to the anus and your waste will leave the body in the usual way.

A low anterior resection is like most abdominal operations. You will need to take laxatives and enemas before surgery to completely clean out the intestines. Just before surgery, you will be given general anesthesia, which puts you into a deep sleep. The surgeon makes the incision only in the abdomen. Then the surgeon removes the cancer and a margin of normal tissue on either side of the cancer, along with nearby lymph nodes and a large amount of fatty and fibrous tissue around the rectum. The colon is then reattached to the rectum that is remaining so that a colostomy is not necessary.

Sometimes, the entire rectum may be removed and the colon attached to the anus. This is called a colo-anal anastomosis (anastomosis means connection). This is a harder procedure to do, but modern techniques have made it possible. Sometimes when a colo-anal anastomosis is done, a small pouch is made by doubling back a short segment of colon (colonic J-pouch) or by enlarging a segment (coloplasty). This small reservoir of colon then functions like the

rectum did before surgery. When special techniques are needed to prevent a permanent colostomy, you may need to have a temporary colostomy opening for about 8 weeks while the bowel heals. A second operation is then done to close the colostomy opening.

Abdominoperineal (AP) resection: This operation is more involved than a low anterior resection. It can be used to treat some stage I cancers and most stage II or III rectal cancers in the lower third of the rectum (the part nearest to the anus), especially if the cancer is growing into the sphincter muscle (the muscle that keeps the anus closed and prevents stool leakage). Here, the surgeon makes one incision in the abdomen, and another in the perineal area around the anus. This incision allows the surgeon to remove the anus and the tissues surrounding it, including the sphincter muscle. Because the anus is removed, you will need a permanent colostomy to allow stool a path out of the body.

The usual hospital stay for a low anterior resection or an AP resection is 4 to 7 days, depending on your overall health. Recovery time at home may be 3 to 6 weeks. If you have had a colostomy, you will need help in learning how to manage it. Specially trained *ostomy nurses* or *enterostomal therapists* can do this. They will usually see you in the hospital before your operation to mark a site for the colostomy opening, and later can come to your house or an outpatient setting to provide you with more training. For more information on colostomies, please see the separate American Cancer Society document, *Colostomy: A Guide*.

Pelvic exenteration: If the rectal cancer is growing into nearby organs, a pelvic exenteration may be recommended. This is an extensive operation. Not only will the surgeon remove the rectum, but also nearby organs such as the bladder, prostate (in men), or uterus (in women) if the cancer has spread to these organs. You will need a colostomy after pelvic exenteration. If the bladder is removed, you will also need a urostomy (opening where urine exits the front of the abdomen and is held in a portable pouch).

Side effects of colorectal surgery

Potential side effects of surgery depend on several factors, including the extent of the operation and a person's general health before surgery. Most people will have at least some pain after the operation, although this can usually be controlled with medicines if needed. Eating problems usually resolve within a few days of surgery.

Other problems may include bleeding from the surgery, blood clots in the legs, and damage to nearby organs during the operation. Rarely, the connections between the ends of the intestine may not hold together completely and may leak, which may lead to infection. It is also possible that the incision might open up, causing an open wound. After the surgery, you might develop scar tissue that causes tissues in the abdomen to stick together. These are called *adhesions* and can sometimes cause pain. In rare cases they may cause the bowel to become blocked, requiring further surgery.

Some people may require a temporary or permanent colostomy after surgery. This may take some time to get used to and may require some lifestyle adjustments. Your surgical team can help you learn what to expect.

Sexual impact of colorectal surgery: If you are a man, an AP resection may stop your erections or ability to reach orgasm. In other cases, your pleasure at orgasm may become less intense. Normal aging may cause some of these changes, but they may be made worse by the surgery.

An AP resection can also cause you to have "dry" orgasms (without semen) by damaging the nerves that control ejaculation. Sometimes the surgery only causes retrograde ejaculation, which means the semen goes backward into the bladder. This difference is important if you want to father a child. Retrograde ejaculation is less serious because infertility specialists can recover sperm cells from the urine, which can be used to fertilize an egg. If sperm cells cannot be recovered from your semen or urine, specialists may be able to retrieve them directly from the testicles by minor surgery, and then use them for in vitro fertilization.

If you are a woman, most colorectal surgeries should not cause any loss of sexual function. Abdominal adhesions (scar tissue) may sometimes cause pain or discomfort during intercourse. Of course, if the uterus is removed, pregnancy will not be possible.

No matter what your gender, a colostomy can have an impact on your body image and your sexual comfort level. While it may require some adjustments, it should not prevent you from having an enjoyable sex life.

More information on dealing with the sexual impact of cancer and its treatment is available in the American Cancer Society documents, *Sexuality and Cancer: For the Man Who Has Cancer and His Partner* and *Sexuality and Cancer: For the Woman Who Has Cancer and Her Partner*.

Surgical treatment of colorectal cancer metastases

Sometimes, surgery for cancer that has spread (metastasized) to other organs can help you to live longer or, depending on the extent of the disease, may even cure you. If only a small number of metastases are present in the liver or lungs (and nowhere else), they can sometimes be removed by surgery. This will depend on their size, number, and location.

In some cases where surgically removing the tumors is not possible, non-surgical treatments may be used to destroy (ablate) tumors in the liver. But these methods are less likely to be curative. Several different techniques may be used.

Radiofrequency ablation (RFA) uses high-energy radio waves for treatment. A thin, needle-like probe placed through the skin and into the tumor releases these radio waves. Placement of the probe is guided by ultrasound or CT scans. The probe releases a high-frequency current that heats the tumor and destroys the cancer cells.

Ethanol (alcohol) ablation, also known as percutaneous ethanol injection (PEI), involves injecting concentrated alcohol directly into the tumor to kill cancer cells. This is usually done through the skin using a needle, which is guided by ultrasound or CT scans.

Cryosurgery destroys a tumor by freezing it with a very cold metal probe. The probe is guided into the tumor using ultrasound. This method can treat larger tumors than either of the other ablation techniques but sometimes requires general anesthesia (where you are asleep).

Since these 3 treatments usually do not require surgery to remove any of the patient's liver, they are often good options for patients whose disease is not curable with surgery.

Hepatic artery embolization is sometimes another option for tumors that cannot be removed. This technique is used to reduce the blood flow in the hepatic artery, the artery that feeds most cancer cells in the liver. This is done by injecting materials that plug up the artery. Most of the healthy liver cells will not be affected because they get their blood supply from the portal vein.

This procedure involves putting a catheter into an artery in the inner thigh and threading it up into the liver. A dye is usually injected into the bloodstream at this time to allow the doctor to 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.

Embolization also reduces some of the blood supply to the normal liver tissue. This may be dangerous for patients with diseases such as hepatitis and cirrhosis that are affecting the part of the liver not affected by cancer.

Radiation therapy

Radiation therapy uses high-energy rays (such as x-rays) or particles to destroy cancer cells. It may be part of treatment for either colon or rectal cancer. Chemotherapy can make radiation therapy more effective against some colon and rectal cancers, and these 2 treatments are often used together.

The main use for radiation therapy in people with colon cancer is when the cancer has attached to an internal organ or the lining of the abdomen. When this occurs, the surgeon cannot be certain that all the cancer has been removed, and radiation therapy may be used to kill any cancer cells remaining after surgery. Radiation therapy is seldom used to treat metastatic colon cancer because of side effects, which limit the dose that can be used.

For rectal cancer, radiation therapy is usually given to help prevent the cancer from coming back in the pelvis where the tumor started. It may be given either before or after surgery, but recently doctors have begun to favor preoperative treatment, along with chemotherapy. If a rectal cancer's size and/or position make surgery difficult, radiation may be used before surgery to shrink the tumor. Radiation therapy can also be given to help control rectal cancers in people who are not healthy enough for surgery.

Radiation also may be used to ease (palliate) symptoms in people with advanced cancer causing intestinal blockage, bleeding, or pain.

Types of radiation therapy

Different types of radiation therapy can be used to treat colon and rectal cancers.

External-beam radiation therapy focuses radiation on the cancer from a machine outside the body called a linear accelerator. This is the type of radiation therapy most often recommended for people with colon cancer.

Before treatments start, the radiation team takes careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. External radiation therapy is much like getting an x-ray, but the radiation is more intense. 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.

Endocavitary radiation therapy, as with external-beam radiation therapy, is delivered from a radiation source outside the body. It is a hand-held device that is placed into the anus. The device delivers high-intensity radiation over a few minutes. This is repeated about 3 more times at about 2-week intervals for the full dose. The advantage of this approach is that the radiation reaches the rectum without passing through the skin and other tissues of the abdomen, which means it is less likely to cause side effects. This can allow some patients, particularly elderly persons, to avoid radical surgery and colostomy. It is used only for small tumors. Sometimes external-beam therapy is also given.

Brachytherapy (internal radiation therapy) uses small pellets of radioactive material placed next to or directly into the cancer. The radiation travels only a short distance, limiting the effects on surrounding healthy tissues. Internal radiation is sometimes used in treating people with rectal cancer, particularly people who are not healthy enough to tolerate curative surgery. This is generally a one-time only procedure and doesn't require daily visits for several weeks.

Side effects of radiation therapy

If you are going to get radiation therapy, it's important to speak with your doctor beforehand about the possible side effects so that you know what to expect. Potential side effects of radiation therapy for colon and rectal cancer can include:

- mild skin irritation at the site where radiation beams were aimed
- nausea
- rectal irritation, which can cause diarrhea, painful bowel movements, or blood in the stool
- bowel incontinence
- bladder irritation, which can cause frequent urination, burning sensations while urinating, or blood in the urine
- fatigue
- sexual problems (impotence in men and vaginal irritation in women)

Most side effects should lessen after treatments are completed, but problems such as rectal and bladder irritation may persist. Some degree of rectal and/or bladder irritation may be a permanent side effect. If you begin to develop these or other side effects, talk to your doctor right away so steps can be taken to reduce or relieve them.

Chemotherapy

Chemotherapy (chemo) is treatment with anti-cancer drugs. *Systemic chemotherapy* uses drugs that are injected into a vein or given by mouth. These drugs enter the bloodstream and reach all areas of the body. This treatment is useful for cancers that have metastasized (spread) beyond the organ they started in. In *regional chemotherapy*, drugs are injected directly into an artery leading to a part of the body containing a tumor. This approach concentrates the dose of chemotherapy reaching the cancer cells. It reduces side effects by limiting the amount reaching the rest of the body. *Hepatic artery infusion*, where chemotherapy is given directly into the hepatic artery, is an example of regional chemotherapy sometimes used for colon cancer that has spread to the liver.

There are several situations in which chemotherapy may be used to treat colon or rectal cancers.

Adjuvant chemotherapy: The use of chemotherapy after surgery, known as adjuvant chemotherapy, can increase the survival rate for patients with some stages of colon cancer and rectal cancer. It is given when there is no evidence of cancer but there is a chance that it might come back. The theory behind adjuvant therapy is that a small number of cancer cells may not have been removed by surgery or may have escaped from the primary tumor and

settled in other parts of the body. The hope is that the chemotherapy can kill these cells, wherever they may be.

Neoadjuvant chemotherapy: For some rectal cancers, chemotherapy is given (along with radiation) before surgery to try to shrink the cancer and make surgery easier. This is known as neoadjuvant treatment.

Chemotherapy for advanced cancers: Chemotherapy can also be used to help shrink tumors and relieve symptoms for more advanced cancers. While it is very unlikely to be curative in such situations, it may greatly extend survival time in some people.

Drugs used to treat colorectal cancer

Several drugs can be used to treat colorectal cancer. Often, 2 or more of these drugs are combined to try to make them more effective.

Fluorouracil (5-FU): This drug had been around for several decades, and it is part of most chemotherapy regimens for colorectal cancer. It is often given together with another drug called leucovorin (or folinic acid), which increases its effectiveness.

There are several different schedules for using this drug. It may be given as an infusion over 2 hours, or (more commonly) as a quick injection followed by continuous infusion over 1 or 2 days. For continuous infusions, the patient wears a small battery-operated pump that infuses 5-FU into an intravenous (IV) catheter.

For most chemotherapy regimens, treatment with 5-FU is repeated every 2 weeks, over a period of 6 months to a year.

The possible side effects of this drug include nausea, loss of appetite, mouth sores, diarrhea, low blood cell counts, sensitivity to sunlight, and a syndrome of hand and foot redness that is sometimes accompanied by blistering or skin peeling.

Capecitabine (Xeloda): This is a chemotherapy drug in pill form. It is usually taken twice a day for 2 weeks, followed by a week off. Once in the body, it is changed to 5-FU when it gets to the tumor site. This drug seems to be about as effective as giving continuous intravenous 5-FU.

While this drug may be taken at home as a pill, it is still a strong chemotherapy medicine. The possible side effects that are similar to those listed for 5-FU. Although most of the side effects seem to be less common with this drug than with 5-FU, problems with the hands and feet are more common.

Irinotecan (Camptosar): This drug is often combined with 5-FU and leucovorin (known as the FOLFIRI regimen) as a first-line treatment for advanced colorectal cancer. In some cases it may be tried by itself as a second-line treatment if other chemotherapy drugs are no longer effective. It is given as an IV infusion over 30 minutes to 2 hours.

One problem with irinotecan is that some people are unable to break down the drug so it stays in the body and causes severe side effects. This is due to an inherited genetic variation that can be tested for. The simplest test is to measure the blood level of bilirubin, a substance made in the liver. If it is slightly elevated, this can be a sign of the genetic variation that makes people sensitive to irinotecan. So far, most doctors aren't routinely testing for the genetic variant itself.

The major possible side effects of irinotecan are severe diarrhea and low blood counts, although other effects such as nausea are possible as well. Your doctor will likely give you medicine to take before treatment to help prevent diarrhea. You need to tell your doctor right away if you develop diarrhea or any other side effects. Your doctor may not advise irinotecan if you are elderly or have serious health problems. In rare cases, severe side effects can even be fatal.

Oxaliplatin (Eloxatin): This drug is usually combined with 5-FU and leucovorin (known as the FOLFOX regimen) or with capecitabine (known as the CapeOX regimen) as a first- or second-line treatment for advanced colorectal cancer. It may also be used as adjuvant therapy after surgery for earlier stage cancers. Oxaliplatin is given as an IV infusion over 2 hours, usually once every 2 or 3 weeks.

Oxaliplatin can affect peripheral nerves, which can cause numbness, tingling, and intense sensitivity to temperature in the extremities, especially the hands and feet. This goes away after treatment has stopped in most patients, but in some cases it can cause long-lasting nerve damage. If you are going to be getting oxaliplatin, talk with your doctor about side effects beforehand, and let him or her know as soon as you develop numbness and tingling or other side effects.

Side effects of chemotherapy

Chemotherapy drugs work by attacking 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 chemotherapy, which can lead to side effects.

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

- hair loss

- mouth sores
- loss of appetite
- nausea and vomiting
- increased chance of infections (due to low white blood cell counts)
- easy bruising or bleeding (due to low blood platelet counts)
- fatigue (due to low red blood cell counts)

Along with these, some side effects are specific to certain medicines. These are discussed above in the descriptions of the individual drugs.

Most side effects are short-term and tend to go away after treatment is finished. There are often ways to lessen these side effects. For example, drugs can be given to help prevent or reduce nausea and vomiting. Do not hesitate to discuss any questions about side effects with the cancer care team.

You should report any side effects or changes you notice while getting chemotherapy to your medical team so that they 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 the effects from getting worse.

Elderly people seem to be able to tolerate chemotherapy for colorectal cancer fairly well. There is no reason to withhold treatment in otherwise healthy people simply because of age.

For more general information about chemotherapy, please see the separate American Cancer Society document, *Understanding Chemotherapy: A Guide for Patients and Families*.

Targeted therapies

As researchers have learned more about the gene and protein changes in cells that cause cancer, they have been able to develop newer drugs that specifically target these changes. These targeted drugs work differently than standard chemotherapy drugs. They often have different (and less severe) side effects. At this time, they are most often used either along with chemotherapy or by themselves if chemotherapy is no longer working.

Bevacizumab (Avastin): Bevacizumab is a manmade version of an immune system protein called a monoclonal antibody. This antibody targets vascular endothelial growth factor (VEGF), a protein that helps tumors form new blood vessels to get nutrients (a process known as angiogenesis). Bevacizumab is most often used along with chemotherapy drugs as a first- or second-line treatment for metastatic colorectal cancer.

Bevacizumab is given by intravenous (IV) infusion, usually once every 2 or 3 weeks. While it has been shown to help improve survival when added to chemotherapy, it can also add to the side effects. Rare but possibly serious side effects include blood clots, holes forming in

the colon (requiring surgery to correct), heart problems, and slow wound healing. More common side effects include high blood pressure, tiredness, bleeding, low white blood cell counts, headaches, mouth sores, loss of appetite, and diarrhea.

Cetuximab (Erbix): This is a monoclonal antibody that specifically attacks the epidermal growth factor receptor (EGFR), a molecule that often appears in high amounts on the surface of cancer cells and helps them grow.

Cetuximab is used in metastatic colorectal cancer, usually after other treatments have been tried. It can be used either with irinotecan or by itself in those who can't take irinotecan or whose cancer is no longer responding to it.

Cetuximab is given by IV infusion, usually once a week. A rare but serious side effect of cetuximab is an allergic reaction during the first infusion, which could cause problems with breathing and low blood pressure. You may be given medicine before treatment to help prevent this. Other, less serious side effects may include an acne-like rash, headache, tiredness, fever, and diarrhea.

Panitumumab (Vectibix): Panitumumab is another monoclonal antibody that attacks colorectal cancer cells. Like cetuximab, it targets the EGFR protein. It is used by itself to treat metastatic colorectal cancer after other treatments have been tried.

Panitumumab is given by IV infusion, usually once every 2 weeks. Most people develop skin problems such as a rash during treatment, which in some cases can lead to infections. Other possible serious side effects are lung scarring and allergic reactions to the drug. Sensitivity to sunlight, fatigue, diarrhea, and changes in fingernails and toenails are also possible.

Clinical trials

You 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 deciding 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 one way to get state-of-the-art cancer care. Still, they are not right for everyone.

Here we will give you a brief review of clinical trials. Talking to your health care team, your family, and your friends can help you make the best treatment choice for you.

What are clinical trials?

Clinical trials are carefully controlled research studies that are done with patients. These studies test whether a new treatment is safe and how well it works in patients, or they may test new ways to diagnose or prevent a disease. Clinical trials have led to many advances in cancer prevention, diagnosis, and treatment.

The purpose of clinical trials

Clinical trials are done to get a closer look at promising new treatments or procedures in patients. A clinical trial is only done when there is good reason to believe that the treatment, test, or procedure being studied may be better than the one used now. Treatments used in clinical trials are often found to have real benefits and may go on to become tomorrow's standard treatment.

Clinical trials can focus on many things, such as:

- new uses of drugs that are already approved by the US Food and Drug Administration (FDA)
- new drugs that have not yet been approved by the FDA
- non-drug treatments (such as radiation therapy)
- medical procedures (such as types of surgery)
- herbs and vitamins
- tools to improve the ways medicines or diagnostic tests are used
- medicines or procedures to relieve symptoms or improve comfort
- combinations of treatments and procedures

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

- Is the treatment helpful?
- What's the best way to give it?
- Does it work better than other treatments already available?
- What side effects does the treatment cause?
- Are there more or fewer side effects than the standard treatment used now?
- Do the benefits outweigh the side effects?
- In which patients is the treatment most likely to be helpful?

Phases of clinical trials

There are 4 phases of clinical trials, which are numbered I, II, III, and IV. We will use the example of testing a new cancer treatment drug to look at what each phase is like.

Phase I clinical trials: The purpose of a phase I study is to find the best way to give a new treatment safely to patients. The cancer care team closely watches patients for any harmful side effects.

For phase I studies, the drug has already been tested in lab and animal studies, but the side effects in patients are not fully known. Doctors start by giving very low doses of the drug to the first patients and increase the doses for later groups of patients until side effects appear or the desired effect is seen. Doctors are hoping to help patients, but the main purpose of a phase I trial is to test the safety of the drug.

Phase I clinical trials are often done in small groups of people with different cancers that have not responded to standard treatment, or that keep coming back (recurring) after treatment. If a drug is found to be reasonably safe in phase I studies, it can be tested in a phase II clinical trial.

Phase II clinical trials: These studies are designed to see if the drug works. Patients are given the best dose as determined from phase I studies. They are closely watched for an effect on the cancer. The cancer care team also looks for side effects.

Phase II trials are often done in larger groups of patients with a specific cancer type that has not responded to standard treatment. If a drug is found to be effective in phase II studies, it can be tested in a phase III clinical trial.

Phase III clinical trials: Phase III studies involve large numbers of patients -- most often those who have just been diagnosed with a specific type of cancer. Phase III clinical trials may enroll thousands of patients.

Often, these studies are randomized. This means that patients are randomly put in one of two (or more) groups. One group (called the control group) gets the standard, most accepted treatment. The other group(s) gets the new one(s) being studied. All patients in phase III studies are closely watched. The study will be stopped early if the side effects of the new treatment are too severe or if one group has much better results than the others.

Phase III clinical trials are usually needed before the FDA will approve a treatment for use by the general public.

Phase IV clinical trials: Once a drug has been approved by the FDA and is available for all patients, it is still studied in other clinical trials (sometimes referred to as phase IV studies). This way more can be learned about short-term and long-term side effects and safety as the drug is used in larger numbers of patients with many types of diseases. Doctors can also learn more about how well the drug works, and if it might be helpful when used in other ways (such as in combination with other treatments).

What it will be like to be in a clinical trial

If you are in a clinical trial, you will have a team of experts taking care of you and watching your progress very carefully. Depending on the phase of the clinical trial, you may receive more attention (such as having more doctor visits and lab tests) than you would if you were treated outside of a clinical trial. Clinical trials are specially designed to pay close attention to you.

However, there are some risks. No one involved in the study knows in advance whether the treatment will work or exactly what side effects will occur. That is what the study is designed to find out. While most side effects go away in time, some may be long-lasting or even life threatening. Keep in mind, though, that even standard treatments have side effects. Depending on many factors, you may decide to enter (enroll in) a clinical trial.

Deciding to enter a clinical trial

If you would like to take part in a clinical trial, you should begin by asking your doctor if your clinic or hospital conducts clinical trials. There are requirements you must meet to take part in any clinical trial. But whether or not you enter (enroll in) a clinical trial is completely up to you.

Your doctors and nurses will explain the study to you in detail. They will go over the possible risks and benefits and give you a form to read and sign. The form says that you understand the clinical trial and want to take part in it. This process is known as giving your informed consent. Even after reading and signing the form and after the clinical trial begins, you are free to leave the study at any time, for any reason. Taking part in a clinical trial does not keep you from getting any other medical care you may need.

To find out more about clinical trials, talk to your cancer care team. Here are some questions you might ask:

- Is there a clinical trial that I could take part in?
- What is the purpose of the study?
- What kinds of tests and treatments does the study involve?
- What does this treatment do? Has it been used before?
- Will I know which treatment I receive?
- What is likely to happen in my case with, or without, this new treatment?
- What are my other choices and their pros and cons?
- How could the study affect my daily life?
- What side effects can I expect from the study? Can the side effects be controlled?
- Will I have to stay in the hospital? If so, how often and for how long?
- Will the study cost me anything? Will any of the treatment be free?
- If I am harmed as a result of the research, what treatment would I be entitled to?

- What type of long-term follow-up care is part of the study?
- Has the treatment been used to treat other types of cancers?

How can I find out more about clinical trials that might be right for me?

The American Cancer Society offers a clinical trials matching service for patients, their family, and friends. You can reach this service at 1-800-303-5691 or on our Web site at <http://clinicaltrials.cancer.org>.

Based on the information you give about your cancer type, stage, and previous treatments, this service can put together a list of clinical trials that match your medical needs. The service will also ask where you live and whether you are willing to travel so that it can look for a treatment center that you can get to.

You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll free at 1-800-4-CANCER (1-800-422-6237) or by visiting the NCI clinical trials Web site at www.cancer.gov/clinicaltrials.

For even more information on clinical trials, the American Cancer Society has a document called *Clinical Trials: What You Need to Know*. You can read this on the Web site, www.cancer.org, or have it sent to you by calling 1-800-ACS-2345.

Complementary and alternative therapies

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that are different from mainstream (standard) medical treatment. These methods can include vitamins, herbs, and special diets, or methods such as acupuncture or massage -- among many others. You may have a lot of questions about these treatments. Here are some you may have thought of already:

- How do I know if a non-standard treatment is safe?
- How do I know if it works?
- Should I try one or more of these treatments?
- What does my doctor know/think about these methods? Should I tell the doctor that I'm thinking about trying them?
- Will these treatments cause a problem with my standard medical treatment?
- What is the difference between "complementary" and "alternative" methods?
- Where can I find out more about these treatments?

The terms can be confusing

Not everyone uses these terms the same way, so it can be confusing. The American Cancer Society uses *complementary* to refer to medicines or methods that are used *along with* your regular medical care. *Alternative* medicine is a treatment used *instead of* standard medical treatment.

Complementary methods: Complementary treatment methods, for the most part, are not presented as cures for cancer. Most often they are used to help you feel better. Some methods that can be used in a complementary way are meditation to reduce stress, acupuncture to relieve pain or peppermint tea to relieve nausea. There are many others. Some of these methods are known to help, while others have not been tested. Some have been proven not be helpful. A few have even been found harmful. However, some of these methods may add to your comfort and well-being.

There are many complementary methods that you can safely use right along with your medical treatment to help relieve symptoms or side effects, to ease pain, and to help you enjoy life more. For example, some people find methods such as aromatherapy, massage therapy, meditation, or yoga to be useful.

Alternative treatments: Alternative treatments are those that are used instead of standard medical care. These treatments have not been proven safe and effective in clinical trials. Some of these methods may even be dangerous and some have life-threatening side effects. The biggest danger in most cases is that you may lose the chance to benefit from standard treatment. Delays or interruptions in your standard medical treatment may give the cancer more time to grow.

Deciding what to do

It is easy to see why people with cancer may consider alternative methods. You want to do all you can to fight the cancer. Sometimes mainstream treatments such as chemotherapy can be hard to take, or they may no longer be working.

Sometimes people suggest that their method can cure your cancer without having serious side effects, and it's normal to want to believe them. But the truth is that most non-standard methods of treatment have not been tested and proven to be effective for treating cancer.

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

- Talk to your doctor or nurse about any method you are thinking about using.
- Check the list of "red flags" below.

- Contact the American Cancer Society at 1-800-ACS-2345 to learn more about complementary and alternative methods in general and to learn more about the specific methods you are thinking about.

Red flags

You can use the questions below to spot treatments or methods to avoid. A "yes" answer to any one of these questions should raise a "red flag."

- Does the treatment promise a cure for all or most cancers?
- Are you told not to use standard medical treatment?
- Is the treatment or drug a "secret" that only certain people can give?
- Does the treatment require you to travel to another country?
- Do the promoters attack the medical or scientific community?

The decision is yours

Decisions about how to treat or manage your cancer are always yours to make. If you are thinking about using a complementary or alternative method, be sure to learn about the method and talk to your doctor about it. With reliable 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 by stage of colon cancer

For colon cancers that have not spread to distant sites, surgery is usually the primary or first treatment. Adjuvant (additional) chemotherapy may also be used. Most adjuvant treatment is given for about 6 months.

Stage 0

Since these cancers have not grown beyond the inner lining of the colon, surgery to take out the cancer is all that is needed. This may be done in many cases by polypectomy or local excision through a colonoscope. Colon resection may be needed if a tumor is too big to be removed by local excision.

Stage I

These cancers have grown through several layers of the colon, but they have not spread outside the colon wall itself. Colectomy -- surgery to remove the section of colon containing cancer and nearby lymph nodes -- is the standard treatment. You do not need any additional therapy.

Stage II

These cancers have grown through the wall of the colon and may extend into nearby tissue. They have not yet spread to the lymph nodes.

Surgery (colectomy) is usually the only treatment needed. If your doctor thinks your cancer is likely to come back because of how it looks under the microscope or other factors, adjuvant chemotherapy may be recommended. Chemotherapy is not standard treatment for this stage of colon cancer, but many doctors recommend it if the risk of recurrence seems high, such as in stage IIB disease. There are clinical trials studying this issue, and you might consider enrolling in one. Doctors aren't sure which chemotherapy regimen might be best in this situation. Some of the more commonly used treatments include FOLFOX (5-FU, leucovorin, and oxaliplatin), 5-FU and leucovorin alone, or capecitabine. Your doctor may recommend one of these if it is better suited to your health needs.

If your surgeon is not sure he or she was able to remove all of the cancer because it was growing into other tissues, radiation therapy may be advised to try to kill any remaining cancer cells. Radiation therapy can be given to the area of your abdomen where the cancer was growing.

Stage III

In this stage, the cancer has spread to nearby lymph nodes, but it has not yet spread to other parts of the body.

Surgery (colectomy) followed by adjuvant chemotherapy is the standard treatment. The FOLFOX regimen is the most common chemotherapy combination, although some doctors may prefer 5-FU and leucovorin, capecitabine and oxaliplatin (CapeOX), or capecitabine alone if they are better suited to your health needs.

Your doctors may also advise radiation therapy if your surgeon feels cancer may have been left behind after surgery.

Stage IV

The cancer has spread from the colon to distant organs and tissues such as the liver, lungs, peritoneum, or ovaries.

Surgery in stage IV disease is usually not done with the expectation of curing the colon cancer. However, if only a few small metastases (usually 5 or fewer) are present in the liver or lung and can be completely removed along with the colon cancer, surgery can help you live longer and may even cure you. This is usually followed by chemotherapy. In some cases, hepatic artery infusion may be used if the tumors were in the liver. If the metastases cannot be surgically removed because they are too large or there are too many of them, chemotherapy may be tried first to shrink the tumors to allow for surgery. Chemotherapy would then be given again after surgery. Another option may be to destroy tumors in the liver with cryosurgery, radiofrequency ablation, or other non-surgical methods.

If the cancer is too widespread to be treated with surgery, operations such as a segmental resection or diverting colostomy may still be used in some cases to relieve or prevent blockage of the colon and to prevent other local complications. In some patients with extensive spread of cancer, such a blockage can be prevented or managed by inserting a stent (a hollow metal or plastic tube) into the colon during colonoscopy to keep it open so that surgery can be avoided.

Most patients with stage IV cancer will get chemotherapy and/or targeted therapies to control the cancer. The most commonly used regimens include:

- FOLFOX (leucovorin [folinic acid], 5-FU, and oxaliplatin), with or without bevacizumab
- FOLFIRI (leucovorin, 5-FU, and irinotecan), with or without bevacizumab
- CapeOX (capecitabine and oxaliplatin), with or without bevacizumab
- 5-FU and leucovorin, with or without bevacizumab
- capecitabine, with or without bevacizumab
- irinotecan, with or without cetuximab
- cetuximab alone
- panitumumab alone

The choice of regimens may depend on several factors, including any previous treatments and your overall health. If one of these regimens is no longer effective, another may be tried.

Recurrent colon cancer

Recurrent cancer means that the cancer has returned after treatment. The recurrence may be local (near the area of the initial tumor), or it may affect distant organs.

If the cancer comes back locally, surgery (followed by chemotherapy) can sometimes help you live longer and may even cure you. If the cancer can't be removed surgically, chemotherapy may be tried first. If it shrinks the tumor enough, surgery may be an option at this point. This would again be followed by more chemotherapy.

If the cancer comes back in a distant site, it is most likely to appear first in the liver. Surgery may be an option in some cases. If not, chemotherapy may be tried first to shrink the tumor(s), which may then be followed by surgery. If the cancer is too widespread to be treated surgically, chemotherapy and/or targeted therapies may be used. Possible regimens are the same as for stage IV disease. The options depend on which, if any, drugs you received before the cancer came back and how long ago you received them, as well as on your health. Surgery may still be needed at some point to relieve or prevent blockage of the colon and to prevent other local complications.

As these cancers can often be difficult to treat, you may also want to speak with your doctor about clinical trials you might be eligible for.

Treatment by stage of rectal cancer

For rectal cancers that have not spread to distant sites, surgery is usually the primary or first treatment. Adjuvant (additional) treatment with radiation and chemotherapy may also be used. Most adjuvant treatment is given for about 6 months.

Stage 0

At this stage the cancer has not grown beyond the inner lining of the rectum. Removing or destroying the cancer is all that is needed. You can be treated with a polypectomy, local excision, or transanal resection. You will need no further treatment.

If you are too sick to withstand surgery, you may be treated only with radiation therapy such as endocavitary radiation therapy (aiming radiation through the anus) or brachytherapy (placing radioactive pellets directly into the cancer), although it's not clear if this is as effective as surgery.

Stage I

In this stage, the cancer has grown through the first layer of the rectum into deeper layers but has not spread outside the rectal wall itself.

Surgery is the main treatment for this stage. Either a low anterior resection or an abdominoperineal resection may be done, depending on exactly where the cancer is found within the rectum. Adjuvant therapy is not needed after these operations, unless the surgeon finds the cancer is more advanced than was thought before surgery.

For some small stage I rectal cancers, another option may be removing them through the anus without an abdominal incision (transanal resection). In most cases, adjuvant therapy with radiation and chemotherapy (usually 5-FU) is advised for patients having such surgery.

If you are too sick to withstand surgery, you may be treated only with radiation therapy such as endocavitary radiation therapy (aiming radiation through the anus) or brachytherapy (placing radioactive pellets directly into the cancer). However, this has not been proven to be as effective as surgery.

Stage II

These cancers have grown through the wall of the rectum and into nearby tissues. They have not yet spread to the lymph nodes.

Stage II rectal cancers are usually treated by low anterior resection or abdominoperineal resection (depending on where the cancer is in the rectum), along with both chemotherapy and radiation therapy. Radiation can be given either before or after surgery. Many doctors now favor giving the radiation therapy along with chemotherapy before surgery (neoadjuvant treatment), as well as giving adjuvant chemotherapy after surgery. Chemotherapy may be the FOLFOX regimen (oxaliplatin, 5-FU, and leucovorin), 5-FU and leucovorin, capecitabine and oxaliplatin (CapeOX), or capecitabine alone, based on what's best suited to your health needs.

If neoadjuvant therapy shrinks the tumor enough, in some cases a transanal full thickness rectal resection can be done instead of a more invasive low anterior resection or abdominoperineal resection. This may avert the need for a colostomy. A problem with this is there is no way of knowing whether the cancer has spread to your lymph nodes or being sure the cancer hasn't spread further in your pelvis. For this reason, the procedure isn't generally recommended.

Stage III

These cancers have spread to nearby lymph nodes but not to other parts of the body.

The rectal tumor is usually removed by low anterior resection or abdominoperineal resection. In rare cases where the cancer has reached nearby organs, a pelvic exenteration may be needed. Radiation therapy is given before or after surgery. As in stage II, many doctors now prefer to give the radiation therapy along with chemotherapy before surgery because it lowers the chance that the cancer will come back in the pelvis. For larger tumors, it may also make the surgery more effective.

After surgery, chemotherapy is given. The most common regimens include FOLFOX (oxaliplatin, 5-FU, and leucovorin), 5-FU and leucovorin, capecitabine and oxaliplatin (CapeOX), or capecitabine alone. Your doctor may recommend one of these if it is better suited to your health needs.

Stage IV

The cancer has spread to distant organs and tissues such as the liver or lungs. Treatment options for stage IV disease depend to some extent on how widespread the cancer is.

If there's a chance that all of the cancer can be removed (for example, there are only a few tumors in the liver or lungs), treatment options include:

- surgery to remove the rectal lesion and distant tumors, followed by chemotherapy (and radiation therapy in some cases)
- chemotherapy, followed by surgery to remove the rectal lesion and distant tumors, usually followed by more chemotherapy and radiation therapy
- chemotherapy and radiation therapy, followed by surgery to remove the rectal lesion and distant tumors, followed by chemotherapy

These approaches may help you live longer and in some cases may even cure you. Surgery to remove the rectal tumor would usually be a low anterior resection or abdominoperineal (AP) resection, depending on where it's located. If you have only liver metastases, you may be treated with chemotherapy given directly into the artery leading to the liver. This shrinks the cancers in the liver more effectively than if the chemotherapy is given intravenously.

If the cancer is more widespread and can't be completely removed by surgery, treatment options may depend on whether the cancer is causing any symptoms. Widespread cancers that are not causing symptoms are usually treated with chemotherapy. The most commonly used regimens include:

- FOLFOX (leucovorin [folinic acid], 5-FU, and oxaliplatin), with or without bevacizumab

- FOLFIRI (leucovorin, 5-FU, and irinotecan), with or without bevacizumab
- CapeOX (capecitabine and oxaliplatin), with or without bevacizumab
- 5-FU and leucovorin, with or without bevacizumab
- capecitabine, with or without bevacizumab
- irinotecan, with or without cetuximab
- cetuximab alone
- panitumumab alone

The choice of regimens may depend on several factors, including any previous treatments and your overall health and ability to tolerate treatment.

If the chemotherapy shrinks the tumors, in some cases it may be possible to consider surgery to try to remove all of the cancer at this point.

Cancers that don't shrink with chemotherapy and widespread cancers that are causing symptoms are unlikely to be cured, and treatment is aimed at relieving symptoms and avoiding long-term complications such as bleeding or blockage of the intestines. Treatments may include one or more of the following:

- surgical resection of the rectal tumor
- surgery to create a colostomy and bypass the rectal tumor
- using a special laser to destroy the tumor within the rectum
- placing a stent (hollow plastic or metal tube) within the rectum to keep it open; this does not require surgery
- radiation therapy and chemotherapy
- chemotherapy alone

If tumors in the liver cannot be removed by surgery because they are too large or there are too many of them, it may be possible to destroy them by freezing (cryosurgery), heating (radiofrequency ablation), vaporizing the tumor with a laser (photocoagulation), or other non-surgical methods.

Recurrent rectal cancer

Recurrent cancer means that the cancer has returned after treatment. It may come back locally (near the area of the initial rectal tumor) or in distant organs. Most recurrences develop in the first 2 to 3 years after surgery.

If the cancer comes back locally, chemotherapy and radiation therapy aimed at the tumor may be given if radiation therapy was not used before. Surgery to remove the cancer is used if possible. In some cases this may be followed by radiation therapy.

If the cancer comes back in a distant site, treatment depends on whether it can be removed by surgery.

If the cancer can be removed, surgery is done to remove the tumor. This is followed by chemotherapy (see treatment of stage IV cancer for a list of possible regimens). If the patient hasn't received chemotherapy within the last year (or never received it), neoadjuvant chemotherapy may be given before surgery as well. When the cancer is in the liver, chemotherapy may be given into the hepatic artery leading to the liver.

If the cancer can't be removed by surgery, chemotherapy is usually the first option. The regimen used will depend on what a person has received previously and on their overall health. If the cancer shrinks enough, surgery may be an option in some cases. This would be followed by more chemotherapy.

As with stage IV cancer, surgery or other approaches may be used at some point to relieve symptoms and avoid long-term complications such as bleeding or blockage of the intestines.

As these cancers can often be difficult to treat, you may also want to speak with your doctor about clinical trials you might be eligible for.

More treatment information

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. Those are available on the NCCN Web site (www.nccn.org).

The American Cancer Society collaborates with the NCCN to produce a version of these treatment guidelines for colorectal cancer, written specifically for patients and their families. This less-technical version is available on both the NCCN Web site (www.nccn.org) and the American Cancer Society Web site (www.cancer.org). A print version can also be requested from the American Cancer Society at 1-800-ACS-2345.

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

What Should You Ask Your Doctor About Colorectal Cancer?

It is important to have frank, open discussions with your cancer care team. They want to answer all of your questions, so that you can make informed treatment and life decisions. For instance, consider these questions:

- Where is my cancer located?
- Has my cancer spread beyond the primary site?
- What is the stage of my cancer and what does that mean in my case?
- What treatment choices do I have?
- What do you recommend and why?
- What risks or side effects are there to the treatments you suggest? What are the chances my cancer will come back with these treatment plans?
- What should I do to be ready for treatment?
- What can I do to reduce the side effects of treatment?
- Should I follow a special diet?

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

What happens after treatment for colorectal cancer?

Completing treatment can be both stressful and exciting. You will be relieved to finish treatment, yet it is hard not to worry about cancer coming back. (When cancer returns, it is called recurrence.) This is a very common concern among those who have had cancer.

It may take a while before your confidence in your own recovery begins to feel real and your fears are somewhat relieved. Even with no recurrences, people who have had cancer learn to live with uncertainty.

Follow-up care

After your treatment is over, it is very important to keep all follow-up appointments. During these visits, your doctors will ask about symptoms, do physical exams, and may order blood tests or imaging studies such as CT scans or PET scans. 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 be permanent. 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.

To some extent, the frequency of follow up visits and tests will depend on the stage of your cancer and the likelihood of recurrence.

History and physical exam: Your doctor will likely recommend getting a history and physical exam every 3 to 6 months for the first 2 years after treatment, then every 6 months or so for the next few years. People who were treated for early stage cancers may need less frequent exams.

Colonoscopy: In most cases, your doctor will recommend a colonoscopy within a year after surgery. If this is normal, it should be repeated in 3 years. If that exam is normal, then you can wait 5 years for your next colonoscopy.

Imaging tests: Whether or not your doctor recommends imaging tests will depend on the stage of your disease. CT scans may be done regularly, such as once a year, for those at higher risk of recurrence, especially in the first 2 years after surgery. Testing may be even more frequent in people who had tumors in the liver or lungs removed.

Blood tests for tumor markers: Carcinoembryonic antigen (CEA) and CA 19-9 are substances found in the blood of some people with colorectal cancer. Tests for one or both of these substances are sometime useful if you have any symptoms that suggest the cancer has come back. Some doctors perform these tests every 3 to 6 months to detect recurrences before you have symptoms. Usually these are most important in the first 2 years after treatment, when most recurrences occur. If tumor marker levels start to rise, colonoscopy or imaging tests may be done to try to locate a recurrence.

For patients with a colostomy

If you have a colostomy, you may feel worried or isolated from normal activities. Whether your colostomy is temporary or permanent, an enterostomal therapist (a health care professional trained to help people with their colostomies) can teach you about the care of your colostomy. You can ask the American Cancer Society about programs offering information and support in your area. For more information, see the separate American Cancer Society document, *Colostomy: A Guide*.

Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself in the office of a new doctor. Your original doctor may have moved or retired, or you may have moved or changed doctors for some reason. It is important that you be able to give your new doctor the exact details of your diagnosis and treatment. Make sure you have the following information handy:

- a copy of your pathology report(s) from any biopsy or surgery
- CT scan and MRI images on a transportable DVD
- if you had surgery, a copy of your operative report(s)
- if you were hospitalized, a copy of the discharge summary that doctors must 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, a list of your drugs, drug doses, and when you took them

It is also important to keep medical insurance. Even though no one wants to think of their cancer coming back, it is always a possibility. If it happens, the last thing you want is to have to worry about paying for treatment.

Lifestyle changes to consider during and after treatment

Having cancer and dealing with treatment can be time-consuming and emotionally draining, but it can also 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 begin this process during cancer treatment.

Make healthier choices

Think about your life before you learned you had cancer. Were there things you did that might have made you less healthy? Maybe you drank too much alcohol, or ate more than you needed, or smoked, or didn't exercise very often. Emotionally, maybe you kept your feelings bottled up, or maybe you let stressful situations go on too long.

Now is not the time to feel guilty or to blame yourself. However, you can start making changes today that can have positive effects for the rest of your life. Not only will you feel better but you will also be healthier. What better time than now to take advantage of the motivation you have as a result of going through a life-changing experience like having cancer?

You can start by working on those things that you feel most concerned about. 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's Quitline[®] tobacco cessation program at 1-800-ACS-2345.

Diet and nutrition

Eating right can be a challenge for anyone, but it can get even tougher during and after cancer treatment. For instance, treatment often may change your sense of taste. Nausea can be a problem. You may lose your appetite for a while and lose weight when you don't want to. On the other hand, some people gain weight even without eating more. This can be frustrating, too.

If you are losing weight or have taste problems during treatment, do the best you can with eating and remember that these problems usually improve over time. You may want to ask your cancer team for a referral to a dietitian, an expert in nutrition who can give you ideas on how to fight some of the side effects of your treatment. You may also find it helps to eat small portions every 2 to 3 hours until you feel better and can go back to a more normal schedule.

One of the best things you can do after treatment is to put healthy eating habits into place. You will be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Try to eat 5 or more servings of vegetables and fruits each day. Choose whole grain foods instead of white flour and sugars. Try to limit meats that are high in fat. Cut back on processed meats like hot dogs, bologna, and bacon. Get rid of them altogether if you can. If you drink alcohol, limit yourself to 1 or 2 drinks a day at the most. And don't forget to get some type of regular exercise. The combination of a good diet and regular exercise will help you maintain a healthy weight and keep you feeling more energetic.

Rest, fatigue, work, and exercise

Fatigue is a very common symptom in people being treated for cancer. This is often not an ordinary type of tiredness but a "bone-weary" exhaustion that doesn't get better with rest. For some, this fatigue lasts a long time after treatment, and can discourage them from physical activity.

However, exercise can actually help you reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel physically and emotionally improved and can cope better.

If you are ill and need to be on bed rest during treatment, it is normal to expect your fitness, endurance, and muscle strength to decline some. Physical therapy can help you maintain strength and range of motion in your muscles, which can help fight fatigue and the sense of depression that sometimes comes with feeling so tired.

Any program of physical activity should fit your own situation. An older person who has never exercised will not be able to take on the same amount of exercise as a 20-year-old who

plays tennis 3 times a week. If you haven't exercised in a few years but can still get around, you may want to think about taking short walks.

Talk with your health care team before starting, and get their opinion about your exercise plans. Then, try to get an exercise buddy so that 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, though, you will need to balance activity with rest. It is okay to rest when you need to. It is really hard for some people to allow themselves to do that when they are used to working all day or taking care of a household. (For more information about fatigue, please see the publication, *Cancer-Related Fatigue and Anemia Treatment Guidelines for Patients*.)

Exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- It strengthens your muscles.
- It reduces fatigue.
- It lowers anxiety and depression.
- It makes you feel generally happier.
- It helps you feel better about yourself.

Any person that has been treated for colorectal cancer may also be at risk for a second colorectal cancer or even for other types of cancer, and we know that exercise plays a role in preventing some cancers. The American Cancer Society, in its guidelines on physical activity for cancer prevention, recommends that adults take part in at least 1 physical activity for 30 minutes or more on 5 days or more of the week.

Can you reduce your risk for cancer recurrence?

Most people want to know if there are things they can do to reduce their risk of cancer coming back. Unfortunately, for most cancers there is little solid evidence that can guide people in this direction. 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 ways of preventing cancer in the first place, not preventing recurrences.

However, some studies have pointed to things people can do that *might* help reduce the risk of colorectal cancer returning.

Physical activity: Two recent studies of people with earlier stage (I, II, or III) colorectal cancers showed that increasing recreational physical activity after diagnosis reduced the risk of death from colorectal cancer by as much as half. The level of activity needed to reduce

risk was about 4 to 5 hours of brisk walking per week. More studies are needed to further define this possible benefit.

Diet: In a large study of patients with stage III colon cancer, those with the highest intakes of meat, fat, refined grains (sugars), and desserts were about 3 times more likely to have a recurrence than those who ate the lowest levels. More research is needed to confirm these results and to determine which of these factors are most strongly linked to cancer recurrence.

How about your emotional health?

Once your treatment ends, you may find yourself overwhelmed by emotions. This happens to a lot of people. You may have been going through so much during treatment that you could only focus on getting through your treatment.

Now you may find that you think about the potential of your own death, or the effect of your cancer on your family, friends, and career. You may also begin to re-evaluate your relationship with your spouse or partner. Unexpected issues may also cause concern -- for instance, as you become healthier and have fewer doctor visits, you will see your health care team less often. That can be a source of anxiety for some.

This is an ideal time to seek out emotional and social 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 individual counselors.

Almost everyone who has been through cancer can benefit from getting some type of support. 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 realistic to go it all by yourself. And your friends and family may feel shut out if you decide not to 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-ACS-2345 and we can put you in touch with an appropriate group or resource.

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 healthy choices and feeling as well as possible, physically and emotionally.

What happens if treatment is no longer working?

If cancer continues to grow after one kind of treatment, or if it returns, it is often 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. On the other hand, when a person has received several different medical treatments and the cancer has not been cured, over time the cancer tends to become resistant to all treatment. At this time it's important to weigh the possible limited benefit of a new treatment against the possible downsides, including continued doctor visits and treatment side effects.

Everyone has his or her own way of looking at this. Some people may want to focus on remaining comfortable during their limited time left.

This is likely to be the most difficult time in your battle with cancer -- when you have tried everything medically within reason and it's just not working anymore. Although your doctor may offer you new treatment, you need to consider that at some point, continuing treatment is not likely to improve your health or change your prognosis or survival.

If you want to continue treatment to fight your cancer as long as you can, you still need to consider the odds of more treatment having any benefit. In many cases, your doctor can estimate the response rate for the treatment you are considering. Some people are tempted to try more chemotherapy or radiation, for example, even when their doctors say that the odds of benefit are less than 1%. In this situation, you need to think about and understand your reasons for choosing this plan.

No matter what you decide to do, it is important that you be as comfortable as possible. Make sure you are asking for and getting treatment for any symptoms you might have, such as pain. This type of treatment is called "palliative" treatment.

Palliative treatment helps relieve these symptoms, but is not expected to cure the disease; its main purpose is to improve your quality of life. Sometimes, the treatments you get to control your symptoms are similar to the treatments used to treat cancer. For example, radiation therapy might be given to help relieve bone pain from bone metastasis. Or chemotherapy might be given to help shrink a tumor and keep it from causing a bowel obstruction. But this is not the same as receiving treatment to try to cure the cancer.

At some point, you may benefit from hospice care. Most of the time, this can be given at home. Your cancer may be causing symptoms or problems that need attention, and hospice focuses on your comfort. You should know that receiving hospice care doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. It just means that the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult stage of your cancer.

Remember also that maintaining hope is important. 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. In a way, pausing at this time in your cancer treatment is an opportunity to refocus on the most important things in your life. This 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.

What's new in colorectal cancer research and treatment?

Research is always under way in the area of colorectal cancer. Scientists are looking for causes and ways to prevent colorectal cancer as well as ways to improve treatments.

Genetics

Scientists are learning more about some of the inherited and acquired changes in DNA that cause cells of the colon and rectum to become cancerous. Recent discoveries of inherited genes that increase a person's risk of developing colorectal cancer are already being used in genetic tests to inform people most at risk.

Advances in understanding how these genes work are expected to eventually lead to new drugs and gene therapies to correct these gene problems. Early phases of gene therapy trials are already in progress.

Chemoprevention

Chemoprevention is the use of natural or man-made chemicals to lower a person's risk of developing cancer. Researchers are testing whether certain supplements, minerals (such as calcium), and vitamins (such as folic acid or vitamin D) can lower colorectal cancer risk.

Some studies have found that people who take multivitamins containing folic acid (also known as folate), vitamin D supplements, or calcium (through either diet or supplements) may have a lower colorectal cancer risk than people who do not. Research to clarify the possible benefits of these and other substances, such as selenium and curcumin, is now under way.

Although taking aspirin or some other non-steroidal anti-inflammatory drugs (NSAIDs) is associated with a lower risk of colorectal cancer, these drugs can cause stomach ulcers and other side effects. For this reason, taking NSAIDs specifically for this purpose is not recommended for people at average colorectal cancer risk.

NSAIDs, such as sulindac and celecoxib (Celebrex), have been shown to reduce formation of adenomatous polyps in people with familial adenomatous polyposis (FAP). The FDA has

approved celecoxib for reducing polyp formation in people with FAP. However, celecoxib may have side effects such as a potential increased heart risk. You should consult with your doctor before beginning regular use of aspirin or another NSAID.

Studies indicate that a diet high in fruits and vegetables may lower colorectal cancer risk, as well as the risk of several other diseases. This hasn't been completely proven by all studies. But it is important that you eat enough servings -- at least 5 a day!

At this time, most experts recommend that people not take large doses of vitamins, minerals, or other agents unless they are part of a study or are under the advice and care of a doctor.

Earlier detection

Colorectal cancer is much easier to treat effectively if it is found at a very early stage. Studies continue to look at the effectiveness of current colorectal cancer screening methods and assess new approaches to informing the public about the importance of being screened. Less than half of Americans age 50 or older have any colorectal cancer screening at all. If everyone were tested as recommended, tens of thousands of lives could be saved each year. The American Cancer Society and other public health organizations are working to increase awareness of colorectal cancer screening among the general public and health care professionals.

Meanwhile, new imaging and lab tests are also being developed and tested. Newer, more accurate ways to look for changes in the stool that might indicate colorectal cancer have been developed. These include tests that are better able to detect blood in the stool (fecal immunochemical tests) and test that can detect changes in the DNA of cells in the stool. CT colonography (also known as virtual colonoscopy) is a special type of CT scan that can find colorectal polyps and cancers at least as accurately as a barium enema.

These tests are described in more detail in the section, "Can colorectal polyps and cancer be found early?"

Treatment

Chemotherapy: Many clinical trials are testing new chemotherapy drugs or drugs that are now used against other cancers (such as cisplatin or gemcitabine). Other studies are looking at ways to combine drugs already known to be active against colorectal cancer, such as irinotecan or oxaliplatin, to improve their effectiveness. Newer studies are also looking at adding targeted therapies such as cetuximab or bevacizumab to chemotherapy as part of adjuvant therapy. Still other studies are testing the best ways to combine chemotherapy with radiation therapy and/or immunotherapy.

Targeted therapies: Several targeted therapies are already approved for treating colorectal cancer, including bevacizumab (Avastin), cetuximab (Erbix), and panitumumab (Vectibix). Doctors continue to study the best way to give these drugs to make them more effective.

Researchers are also studying dozens of new targeted therapies to increase the options for people with colorectal cancer. Some of these are monoclonal antibodies like the drugs listed above, while others are more like conventional drugs that are given in pill form.

Immunotherapy: Researchers are studying several vaccines to try to treat colorectal cancer or prevent it from coming back after treatment. Unlike vaccines that prevent infectious diseases, these vaccines are meant to boost the patient's immune reaction to fight colorectal cancer more effectively.

There are many types of vaccines being studied. For example, some vaccines involve removing some of the patient's own immune system cells (called dendritic cells) from the blood, exposing them in the lab to a substance that will make them attack cancer cells, and then putting them back into the body. At this time, such vaccines are only available in clinical trials.

Additional resources

More information from your American Cancer Society

We have selected some related information that may also be helpful to you. These materials may be viewed on our Web site or ordered from our toll-free number, 1-800-ACS-2345.

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

ACS/NCCN Colon and Rectal Cancer: Treatment Guidelines for Patients

Colostomy: A Guide (also available in Spanish)

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

Sexuality & Cancer: For the Man Who Has Cancer and His Partner (also available in Spanish)

Sexuality & Cancer: For the Woman Who Has Cancer and Her Partner (also available in Spanish)

Surgery (also available in Spanish)

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

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

The following books are available from the American Cancer Society. Call us at 1-800-ACS-2345 to ask about costs or to place your order.

The American Cancer Society's Complete Guide to Colorectal Cancer

Caregiving: A Step-By-Step Resource for Caring for the Person With Cancer at Home

National organizations and Web sites*

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

American College of Gastroenterology
Web site: www.acg.gi.org

American Gastroenterological Association
Telephone: 1-301-654-2055
Web site: www.gastro.org

American Society of Colon and Rectal Surgeons
Web site: www.fascrs.org

Colon Cancer Alliance
Toll-free number: 1-877-422-2030
Web site: www.ccalliance.org

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

National Colorectal Cancer Research Alliance
Web site: www.eif.nccra.org

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

Other resources*

The following book is one woman's experience with colon cancer and with the health care system. The book provides lessons about how to deal with unexpected life-threatening illnesses; how to identify and assess treatment options; how to communicate with health care providers; and how to navigate the health care system.

Kingson, Eric C. *Lessons from Joan: Living and Loving with Cancer, a Husband's Story*. Syracuse University Press. Syracuse, NY. www.SyracuseUniversityPress.syr.edu

**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-ACS-2345** or visit www.cancer.org.

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