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NCCN GUIDELINES FOR PATIENTS®

Version 1.2017

Colon Cancer

Presented with support from:

NCCN National Comprehensive Cancer Network FOUNDATION®
Guiding Treatment, Changing Lives.

FIGHT COLORECTAL CANCER

Available online at NCCN.org/patients

LEARNING that you have cancer can be overwhelming.

The goal of this book is to help you get the best care. It presents which cancer tests and treatments are recommended by experts in colon cancer.

The National Comprehensive Cancer Network® (NCCN®) is a not-for-profit alliance of 27 leading cancer centers. Experts from NCCN have written treatment guidelines for doctors who treat colon cancer. These treatment guidelines suggest what the best practice is for cancer care. The information in this patient book is based on the guidelines written for doctors.

This book focuses on the treatment of colon cancer. Key points of the book are summarized in the NCCN Quick Guide™. NCCN also offers patient books on ovarian cancer, stomach cancer, sarcoma, lymphomas, and other cancer types. Visit NCCN.org/patients for the full library of patient books, summaries, and other resources.

About

National Comprehensive Cancer Network®

These patient guidelines for cancer care are produced by the National Comprehensive Cancer Network® (NCCN®).

The mission of NCCN is to improve cancer care so people can live better lives. At the core of NCCN are the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®). NCCN Guidelines® contain information to help health care workers plan the best cancer care. They list options for cancer care that are most likely to have the best results. The NCCN Guidelines for Patients® present the information from the NCCN Guidelines in an easy-to-learn format.

Panels of experts create the NCCN Guidelines. Most of the experts are from NCCN Member Institutions. Their areas of expertise are diverse. Many panels also include a patient advocate. Recommendations in the NCCN Guidelines are based on clinical trials and the experience of the panelists. The NCCN Guidelines are updated at least once a year. When funded, the patient books are updated to reflect the most recent version of the NCCN Guidelines for doctors.

For more information about the NCCN Guidelines, visit NCCN.org/clinical.asp.

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NCCN FOUNDATION®
Guiding Treatment, Changing Lives.

NCCN Foundation was founded by NCCN to raise funds for patient education based on the NCCN Guidelines. NCCN Foundation offers guidance to people with cancer and their caregivers at every step of their cancer journey. This is done by sharing key information from leading cancer experts. This information can be found in a library of NCCN Guidelines for Patients® and other patient education resources. NCCN Foundation is also committed to advancing cancer treatment by funding the nation's promising doctors at the center of cancer research, education, and progress of cancer therapies.

For more information about NCCN Foundation, visit NCCNFoundation.org.

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Fight Colorectal Cancer
As an organization dedicated to helping patients, caregivers and those impacted by colorectal cancer find trusted resources and information they need to make informed decisions about their health, we are proud to support this comprehensive resource. FightColorectalCancer.org.

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Colon Cancer Alliance
The Colon Cancer Alliance is pleased to endorse the NCCN Guidelines for Colon Cancer as a resourceful tool to help knock colon cancer out of the top three cancer killers. ccalliance.org.









Contents

How to use this book

Who should read this book?

This book is about treatment for adenocarcinoma of the colon. It does not discuss rectal cancer. Patients and those who support them—caregivers, family, and friends—may find this book helpful. It is a good starting point to learn what your options may be.

Are the book chapters in a certain order?

Early chapters explain concepts that are repeated in later chapters. Starting with **Part 1** may help. It explains what colon cancer is. It also explains how colon cancer is found and cancer stages.

It is important to know the stage of the cancer. Your treatment plan will be partly based on the cancer stage. Tests that help doctors plan treatment are described in **Part 2**.

An overview of treatments for colon cancer is presented in **Part 3**. Knowing what a treatment is will help you understand your options. Treatment options are presented in **Parts 4 through 6** partly based on the cancer stage. Tips for talking and deciding your options with your doctor are presented in **Part 7**.

Does this book include all options?

This book includes information for many people. Your treatment team can point out what applies to you. They can also give you more information. While reading, make a list of questions to ask your doctors.

The treatment options are based on science and the experience of NCCN experts. However, their recommendations may not be right for you. Your doctors may suggest other options based on your health and other factors. If other options are given, ask your treatment team questions.

Help! What do the words mean?

In this book, many medical words are included. These are words that your treatment team may say to you. Most of these words may be new to you. It may be a lot to learn.

Don’t be discouraged as you read. Keep reading and review the information. Ask your treatment team to explain a word or phrase that you do not understand.

Words that you may not know are defined in the text or in the *Dictionary*. Acronyms are also defined when first used and in the *Glossary*. Acronyms are short words formed from the first letters of several words. One example is DNA for **d**eoxyribo**n**ucleic **a**cid.

1
Colon cancer basics

You've learned that you have colon cancer. It's common to feel shocked and confused. Part 1 reviews some basics that may help you learn about colon cancer.

The colon

Before learning about colon cancer, it is helpful to know about the colon. The colon is part of the digestive system. This system breaks down food for the body to use.

Digestive tract

After being swallowed, food moves through four organs known as the digestive tract. **See Figure 1**. First, food passes through the esophagus and into the stomach.

In the stomach, food is turned into a liquid. From the stomach, food enters the small intestine. In the small intestine, food is broken down into very small parts. This allows nutrients to be absorbed into the bloodstream.

From the small intestine, food moves into the large intestine. The large intestine changes unused food from a liquid into a solid by absorbing water. This solid, unused food is called feces or stool. The large intestine also expels stool from the body.

The colon is part of the large intestine. It is almost 5 feet long. Its four parts are the ascending, transverse, descending, and sigmoid colon.

Colon wall

The wall of the colon has four main layers. **See Figure 2**. The inner layer that has contact with stool is called the mucosa. The mucosa consists of three sublayers. They are the epithelium, lamina propria, and muscularis mucosae.

The epithelium absorbs water from stool and makes mucus. Mucus is a sticky, thick liquid that protects the colon. It also helps move stool through the colon. The lamina propria is a thin layer of connective tissue. The muscularis mucosae is a thin strip of muscle.

The second layer of the colon wall is called the submucosa. It consists of connective tissue, blood and lymph vessels, and nerve cells. Lymph is a clear fluid that gives cells water and food. It also has white blood cells that fight germs. Blood and lymph drain from colon tissue into vessels that are in the submucosa and then travel to other sites.

The third layer of the colon wall is called the muscularis propria. It is mostly made of muscle fibers. These muscles help move stool through the colon.

The fourth layer is the outer most part of the colon wall. It consists either of adventitia or serosa. Adventitia is connective tissue that binds the colon to other structures. The serosa, also called the visceral peritoneum, is a membrane.

The serosa contains has a thin layer of connective tissue. This tissue is called the subserosa. It is covered by a single row of cells that make fluid. This fluid allows the colon to move smoothly against other organs.

Figure 1
The digestive tract

The digestive tract consists of 4 main parts. The esophagus moves food from your throat to your stomach. In the stomach, food is turned into a liquid. Nutrients from the liquid are absorbed into your body within the small intestine. The large intestine absorbs liquid from and pushes unused food out of the body.

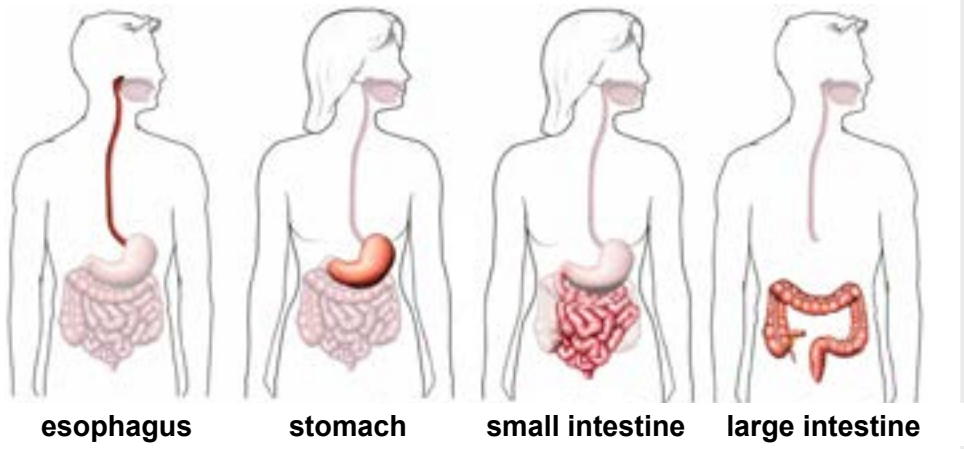
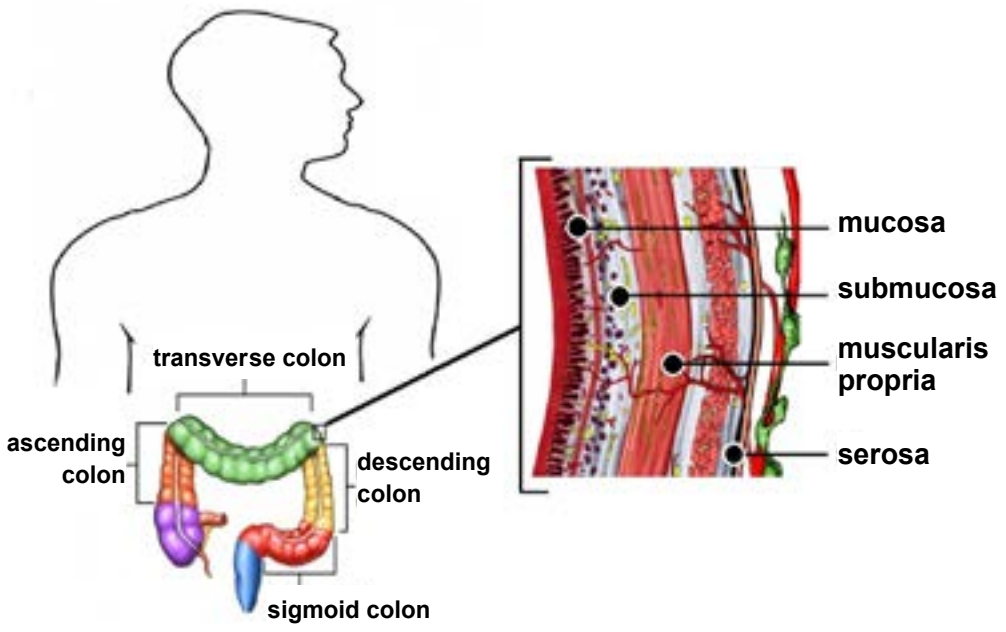


Figure 2
The colon

The colon is part of the large intestine. It is almost 5 feet long. It has four sections—the ascending, transverse, descending, and sigmoid colon. Its wall has four main layers—the mucosa, submucosa, muscularis propria, and serosa or adventitia.



A disease of cells

Your body is made of trillions of cells. Cancer is a disease of cells. Each type of cancer is named after the cell from which it derived. Colon cancer is a cancer of colon cells.

Almost all colon cancers are adenocarcinomas. Adenocarcinomas are cancers of cells that line glands and, in the case of colon cancer, make mucus. Adenocarcinomas of the colon are the focus of this book.

Cells have a control center called the nucleus. The nucleus contains chromosomes, which are long strands of DNA (**d**eoxyribo**n**ucleic **a**cid) tightly wrapped around proteins. **See Figure 3**. Within DNA are coded instructions for building new cells and controlling how cells behave. These instructions are called genes.

There can be abnormal changes in genes called mutations. Some types of mutations that are linked to cancer are present in all cells. Other mutations are present only in cancer cells. Mutations cause cancer cells to not behave like normal cells and, sometimes, to look very different from normal cells.

Cancer's threat

Cancer cells don't behave like normal cells in three key ways. First, cancer cells grow more quickly and live longer than normal cells. Normal cells grow and then divide to form new cells when needed. They also die when old or damaged as shown in **Figure 4**. In contrast, cancer cells make new cells that aren't needed and don't die quickly when old or damaged. Over time, cancer cells form a mass called the primary tumor.

The second way cancer cells differ from normal cells is that they can grow into surrounding tissues. If not treated, the primary tumor can grow through the colon wall. They can even grow into nearby structures. Colon cancers that haven't grown into the second layer of the colon wall are called "noninvasive cancers." Colon cancers that have grown into the second layer are called "invasive cancers."

Third, unlike normal cells, cancer cells can leave the colon. This process is called metastasis. In this process, cancer cells break away from the tumor and merge with blood or lymph. Then, the cancer cells travel in blood or lymph through vessels to other sites. Once in other sites, cancer cells may form secondary tumors and cause major health problems.

Figure 3
Genetic material in cells

Most human cells contain the "blueprint of life"—the plan by which our bodies are made and work. The plan is found inside of chromosomes, which are long strands of DNA that are tightly wrapped around proteins. Genes are small pieces of DNA that contain instructions for building new cells and controlling how cells behave. Humans have an estimated 20,000 to 25,000 genes.

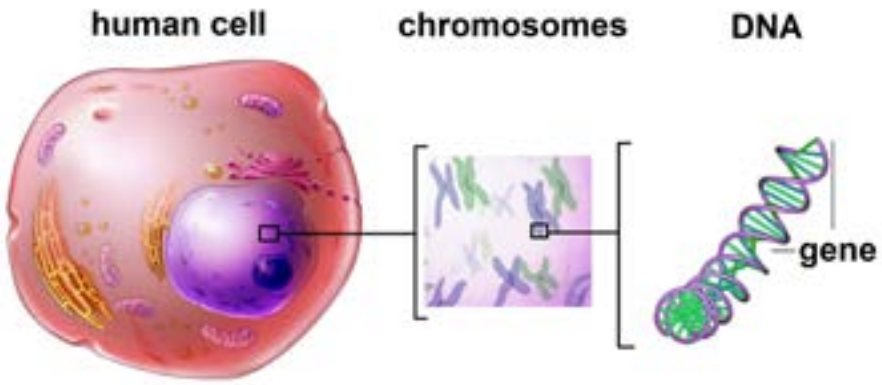
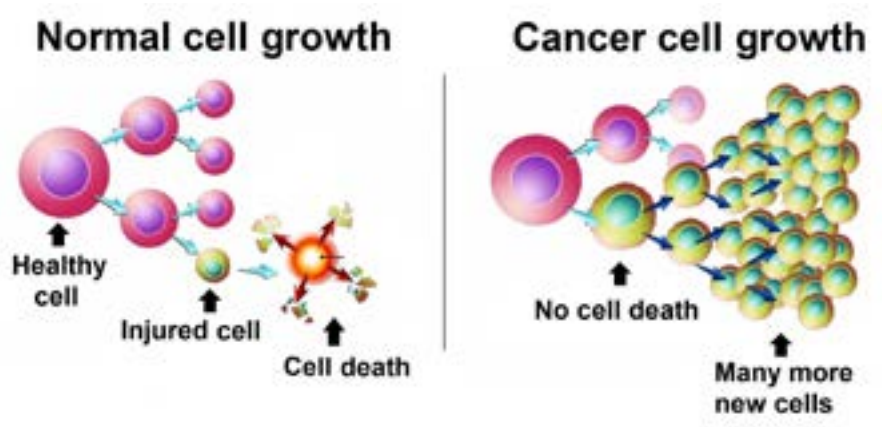


Figure 4
Normal cell growth vs. cancer cell growth

Normal cells increase in number when they are needed and die when old or damaged. In contrast, cancer cells quickly make new cells and live longer because of abnormal changes in genes.



Polyps

Colon cancer often starts in a polyp. A polyp is an overgrowth of cells that line the inner colon wall. **See Figure 5.** Polyps need to be removed and tested for cancer. An endoscopic polypectomy is a minor surgery that removes polyps.

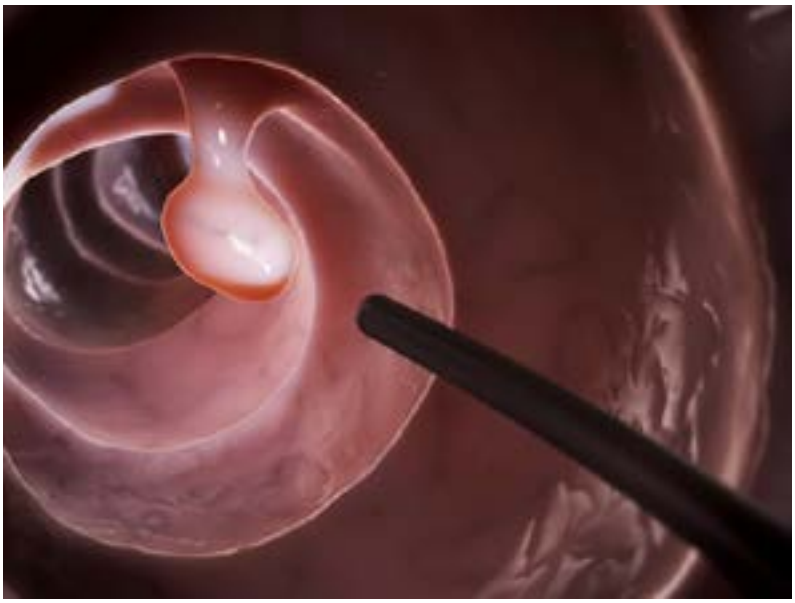
Not all polyps are the same. They differ in size, shape, and how their cells look. There are three types of colon polyps.

- **Adenomatous polyps**, or **adenomas**, have cells that don't look like normal colon cells. They are the most common type of polyp. Most do not become cancer, but most polyps with cancer started as adenomas.
- **Hyperplastic polyps** have cells that grow fast. They are often found in the last part of the colon and in the rectum. They rarely become cancer.
- **Inflammatory polyps** often grow after a flare-up of an inflammatory bowel disease. They can have any shape. The chance of them becoming cancer is low.

Sessile polyps are flat polyps that grow flush along the colon wall and do not have a stalk. Sometimes, they can be hard to spot. Pedunculated polyps are shaped like mushrooms. They have a stalk and round top. Serrated is a term for any polyp that has a saw-tooth pattern. Sessile serrated adenomas are rare but have been linked to cancer.

Figure 5
Colon polyp

A colon polyp is an overgrowth of cells that line the inner surface of the colon wall. Colon cancer often starts in a polyp. However, most polyps do not become cancer.



Cancer stage

A cancer stage is a rating by your doctors of the extent of the cancer. It is used to plan which tests may be needed and which treatments are best for you. The AJCC (**A**merican **J**oint **C**ommittee on **C**ancer) staging system is used to stage colon cancer.

In the AJCC system, the letters T, N, and M describe the areas of cancer growth. The T score describes the growth of the primary tumor. The N score describes nearby cancer growth within the colon or lymph nodes. The M score tells if the cancer has spread to distant sites.

The T, N, and M scores are combined to assign the cancer a stage. There are five stages of colon cancer. They are numbered 0, I (1), II (2), III (3), or IV (4). The stages are defined as:

Stage 0
These cancers are also called carcinoma in situ of the colon. The cancer has not grown beyond the first layer of the colon wall. It is a noninvasive cancer. More treatment may not be needed if all the cancer was removed during an endoscopic polypectomy.

Stage I
The cancer has grown into either the second or third layer of the colon wall. There is no cancer in nearby or distant sites.

Stage II
The cancer has grown into the fourth layer of or outside the colon wall. There is no cancer in nearby or distant sites.

Stage III
The cancer has spread from the colon to nearby lymph nodes or there are tumor deposits. Tumor deposits are small secondary tumors within the colon.

Stage IV
The colon cancer has spread to distant organs. Common distant sites include your liver and lungs.

Rating of the cancer stage is often done twice. The first rating is based on tests before treatment and is called the clinical stage. Exactly how far the cancer has spread and how many lymph nodes have cancer may not be known until after surgery. Thus, your doctors will rate the cancer again after surgery. This rating is called the pathologic stage.

Review

- The colon absorbs water from unused food in the body.
- The wall of the colon has four layers.
- Colon cancer is a cancer of cells that line the inner colon wall and make mucus.
- Cancer cells form a tumor since they don't grow and die as normal cells do.
- Cancer cells can spread to other body parts through lymph or blood.
- Most colon cancers start in polyps.
- The cancer stage is a rating by doctors of the extent of cancer.

2
Treatment planning

Not all colon cancers are the same. Your cancer doctor will want to learn all about the cancer you have. Part 2 describes the tests used to learn about colon cancer. Based on the results, your treatment can be tailored to you. This is called personalized medicine.

Medical history

Your medical history includes any health events and medicines you've taken in your life. It helps your doctors decide if you can have surgery. It also helps doctors assess if chemotherapy will do you more good than harm.

Colon cancer and other health conditions can run in families. Thus, your doctor will ask about the medical history of your blood relatives. It's important to know who in your family has had what diseases and at what ages. You doctor may ask about the health of your siblings, your parents and their siblings, and your grandparents and their siblings.

Colon cancer often occurs for unknown reasons. However, some people have syndromes that increase their chance of getting colon cancer. A syndrome is a group of signs or symptoms that occur together and suggest the presence of or risk for a disease. Some syndromes that increase the risk for colon cancer are passed down from parents to child (inherited).

Lynch syndrome is an inherited syndrome. It's also called HNPCC (**h**ereditary **n**on-**p**olyposis **c**olon **c**ancer). It's the most common type of inherited syndrome to cause colon cancer. It also increases the risk for other types of cancer. Even so, only 3 to 5 out of every 100 people with colon cancer have Lynch syndrome.

FAP (**f**amilial **a**denomatous **p**olyposis) is a rare inherited syndrome that often leads to colon cancer. However, only 1 out of 100 people with colon cancer have FAP. FAP starts with hundreds of polyps forming in the colon and rectum. You are likely to have cancer by age 50 if you have classic FAP. In attenuated FAP, the disease starts later in life and fewer than 100 polyps occur.

"Don't lose hope! Live every day to the fullest and share your story with everyone you can. You will rapidly find that there are others all around you who are also impacted by this disease. Together we can build a better future.

–Sandy
Survivor, Stage III

If you may have an inherited syndrome, you may be referred to a genetic counselor. A genetic counselor can talk with you about getting tested for syndromes related to colon cancer. To be tested, you must provide a sample of blood. Using the sample, a pathologist can test your genes for abnormal changes that cause these syndromes.

A medical history is needed for treatment planning. See Guide 1 for a complete list of care that is advised prior to treatment. Some tests are for anyone with colon cancer while others are for a select group.

Physical exam

Doctors often perform a physical exam along with taking a medical history. A physical exam is a study of your body for signs of disease. To start, your basic body functions will be measured. These functions include your temperature, blood pressure, and pulse and breathing (respiration) rate. Your weight will also be checked.

During the exam, your doctor will listen to your lungs, heart, and gut. Your doctor will also look at and feel parts of your body. This is done to see if organs are of normal size, are soft or hard, or cause pain when touched. Cancer and other health conditions can cause organs to become enlarged and hard.

Guide 1. Health care before cancer treatment

Tests	For what colon stage?
Medical history	All cancer stages
Physical exam	All cancer stages
Total colonoscopy	All cancer stages
Complete blood count	Stage II, III, and IV
Chemistry profile	Stage II, III, and IV
CT with contrast	Stage II, III, and IV
MRI with contrast + CT without contrast	Some stage II and III if CT unclear or CT with contrast isn't an option
MRI with contrast	Some stage IV if CT unclear
PET/CT	Some stage IV if CT with contrast isn't an option
Needle biopsy	Some stage IV
RAS test	Stage IV
BRAF test	Stage IV
MMR or MSI test	All cancer stages

Total colonoscopy

A colonoscopy is a procedure that allows your doctor to examine your colon. A total colonoscopy is a study of your entire large intestine. Your doctor will look for polyps and other diseases.

You may be put on a liquid diet for 1 to 3 days before the test. You may also take a laxative or an enema the night before. This will clean out your intestine.

Right before the test, you may be given a sedative to lessen any pain. As shown in **Figure 6**, you will likely wear a hospital gown. The test will be performed while you lie on your side.

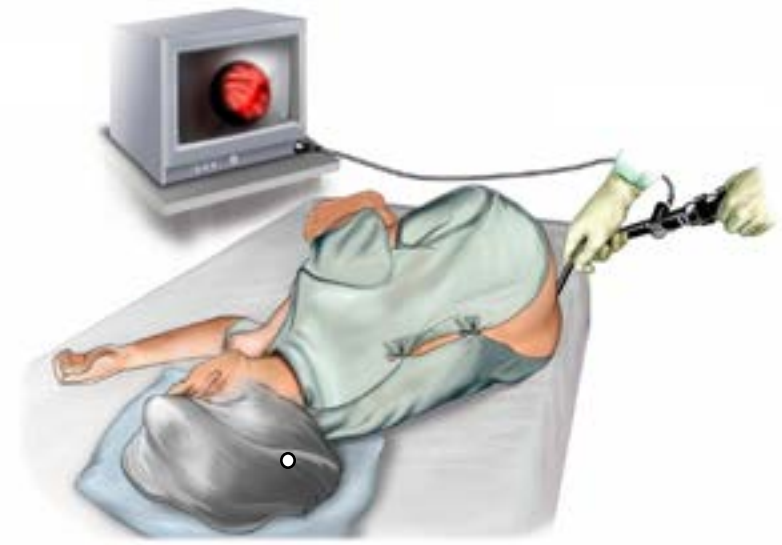
A colonoscope is the device used for the test. Part of it looks like a thin tube. It has a light and camera. This part will be inserted into your anus and gently guided through your large intestine.

To see better, gas may be pumped into your intestine to make it bigger. You may be asked to shift a little to help your doctor guide the device. A picture of your colon will be viewed by your doctor on a screen. If a polyp is found, a cutting tool will be inserted through the tube to remove it.

A colonoscopy takes about 30 to 60 minutes. Afterward, you may stay for another hour for any drugs that were used to wear off. However, you'll still need someone to drive you home. The next day, you will likely feel normal. If you have severe pain, bloody stool, or weakness, contact your doctor.

Figure 6
Total colonoscopy

Your entire colon should be examined if you have colon cancer. A total colonoscopy is a procedure that allows your doctor to look for and remove any tissue that looks abnormal. It involves inserting a thin device into your body that has a light, camera, and cutting tool.



Blood tests

Blood tests are used to look for signs of disease. A needle will be inserted into your vein to remove a sample of blood. The needle may bruise your skin and you may feel dizzy from the blood draw. Your blood sample will then be sent to a lab where a pathologist will test it. A pathologist is a doctor who's an expert in testing cells to find disease.

Complete blood count

A CBC (**c**omplete **b**lood **c**ount) measures the number of blood cells in a blood sample. It includes numbers of white blood cells, red blood cells, and platelets. Cancer and other health problems can cause low or high counts.

Chemistry profile

Another blood test is a chemistry profile. When colon cancer spreads, it can cause high or low levels of chemicals in the blood. One example is a high CEA (**c**arcino**e**mbryonic **a**ntigen) level. CEA is normally low in healthy adults unless a woman is pregnant. High CEA levels suggest the cancer has spread far.

Imaging tests

Imaging tests make pictures (images) of the insides of your body. They can show which sites have cancer. This information helps your doctors stage the cancer and plan treatment. Certain imaging tests also reveal some features of a tumor and its cells.

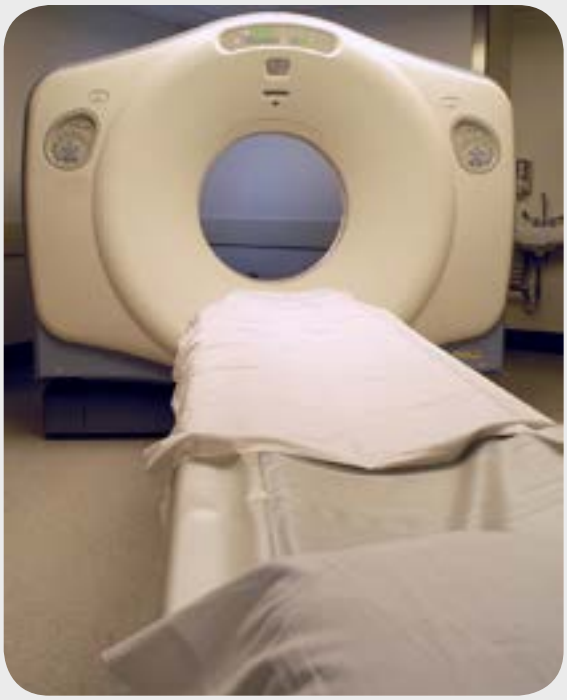
A radiologist is a doctor who's an expert in reading images. Your radiologist will convey the imaging results to your cancer doctor. This information helps your doctor decide what the next steps of care should be.

Your treatment team will tell you how to prepare for these tests. You may need to stop taking some medicines and stop eating and drinking for a few hours before the scan. Tell your team if you get nervous when in small spaces. You may be given a sedative to help you relax.

Figure 7 shows one type of imaging machine. Imaging machines are large. You will likely be lying down during testing. At least part of your body will be in the machine.

Figure 7
CT machine

Pictures of the insides of your body can be made with an imaging test. During the scan, you will lie on a table that will move into the tunnel of the imaging machine. The pictures will be viewed by a doctor who will look for signs of cancer.



Some imaging tests use contrast. Contrast is a dye that will be injected into your bloodstream. It makes the pictures clearer. Some people have an allergic reaction to the dye. Tell your doctor if you've had problems with contrast in the past.

CT with contrast

CT (**c**omputed **t**omography) takes many pictures of a body part using x-rays. A computer combines the x-rays to make one detailed picture. The picture is saved for later viewing by the radiologist.

CT is advised if the cancer has spread beyond the second layer of your colon wall. Get scans of your chest, abdomen, and pelvis. Contrast should be used. The radiologist will look for cancer in nearby and distant sites.

During the scan, you will need to lie face up on a table. The table will move through the machine. As the machine takes pictures, you may hear buzzing, clicking, or whirring sounds.

You will be alone in the room during the test. In a nearby room, the technician will operate the machine. He or she will be able to see, hear, and speak with you at all times. One scan is completed in about 30 seconds. You will likely be able to resume your activities right away unless you took a sedative.

MRI

MRI (**m**agnetic **r**esonance **i**maging) uses a magnetic field and radio waves to make pictures. It is not often used to plan treatment for colon cancer. Your doctor may order an MRI if the CT scan was unclear. Contrast should be used. For stages II or III, CT without contrast may also be done if you can't receive CT contrast.

Getting MRI is much like getting CT. Except, you will need to wear a coil device. The device covers your body from below your chest to the top of your legs. It sends and receives radio waves. Straps may be used to help you stay in place. MRI may cause your body to feel a bit warm.

PET/CT

Sometimes CT is combined with PET (**p**ositron **e**mission **t**omography). When used together, they are called a PET/CT scan. PET/CT scan is not often used to plan treatment for colon cancer.

There are three reasons why you may have a PET/CT scan. PET/CT can show how big a tumor is if you have metastases. PET/CT can also find metastases other than in the liver that would exclude surgery. Last, PET/CT may be an option if you can't receive contrast dye for CT or MRI.

PET/CT may be done with one or two machines depending on the cancer center. For PET, a sugar radiotracer will first be injected into your body. The radiotracer is detected with a special camera during the scan. Cancer cells appear brighter than normal cells because they use sugar more quickly. PET can show even small amounts of cancer.

Needle biopsy

Samples of tissue or fluid can sometimes be removed from the body with a needle. This procedure is called a needle biopsy. The methods of obtaining samples with a needle differ based on the body site. If your doctor suspects metastases, a needle biopsy may be done. The samples will be sent to a pathologist for cancer testing.

Cancer cell tests

Tissue removed from your body will be sent to a pathologist. This may be tissue from a biopsy or surgery. The pathologist will examine the samples using a microscope.

Pathology report

The pathologist will study the parts of the cells to classify any disease. This is called histologic typing. When cancer is found, he or she will do other tests to learn more about the cancer.

One important test result is the cancer grade. The cancer grade is a score assigned by the pathologist. He or she will rate the cancer based on how the cancer cells look. The score is a sign of how fast the cancer will likely grow and spread. Higher scores mean that the cancer will likely grow and spread fast.

All lab results are recorded in a pathology report. A report will be written each time tissue is removed from your body and tested for cancer. These reports are vital to planning treatment.

Review your pathology report(s) with your doctor. Ask questions if you don't understand. This information can be complex. It's also a good idea to get a copy of your pathology report(s) and take notes.

Molecular testing

Not all colon cancer cells are alike. Cancer cells can differ by which genes have mutations. Some gene mutations are known to have an effect on cancer treatment. Molecular testing includes tests of genes or their products (proteins). Molecular testing that is advised for colon cancer is described next.

RAS mutation

RAS is a family of proteins found in cells. Some colon cancers have abnormal genes that control the RAS proteins. As a result, the RAS proteins are overactive and promote cancer cell growth. Some treatments for metastatic colon cancer do not work if the *RAS* genes are abnormal. Thus, testing for mutations in *KRAS* and *NRAS* genes is advised for metastatic disease.

BRAF mutation

The BRAF V600E mutation is also known to affect some treatments. About 5 to 9 out of every 100 colon cancers have a mutated *BRAF* gene. Testing for the *BRAF V600E* mutation is advised for metastatic disease.

MMR and MSI

Normal MMR (**m**is**m**atch **r**epair) proteins correct DNA errors that occur when copies of DNA are being made. In some colon cancers, MMR mutations cause one or more MMR proteins to be absent. As a result, DNA errors aren't corrected and the number of gene mutations increases. Doctors call this dMMR (**d**efective **m**is**m**atch **r**epair).

The DNA errors caused by dMMR often occur in microsatellites. Microsatellites are a tiny part of the DNA code that is repeated many times in a row. **See Figure 8.** Due to dMMR, microsatellites may be shorter or longer than normal. This is called MSI (**m**icro**s**atellite **i**nstability).

Loss of MMR proteins and MSI are features of Lynch syndrome. One or both features is present in over 90 of every 100 Lynch syndrome-related cancers (>90%). However, these features can still occur in the absence of Lynch syndrome. They are found in about 15 out of every 100 colon cancers (15%) without Lynch syndrome.

Testing for loss of MMR proteins or MSI is advised for all people with colon or rectal cancer. These features may affect your treatment plan. There are two tests that can be done.

PCR (**p**olymerase **c**hain **r**eaction) is a test that can assess for MSI. The test consists of a process in

which millions of copies of a DNA part are made. The copies will be examined for 5 MSI markers. Tumors can be rated as MSS (**m**icro**s**atellite-**s**table), MSI-L (**m**icro**s**atellite **i**nstability-**l**ow), and MSI-H (**m**icro**s**atellite **i**nstability-**h**igh). MSI-H is defined as the presence of 2 or more MSI markers. MSI-H suggests dMMR but more testing is needed to confirm.

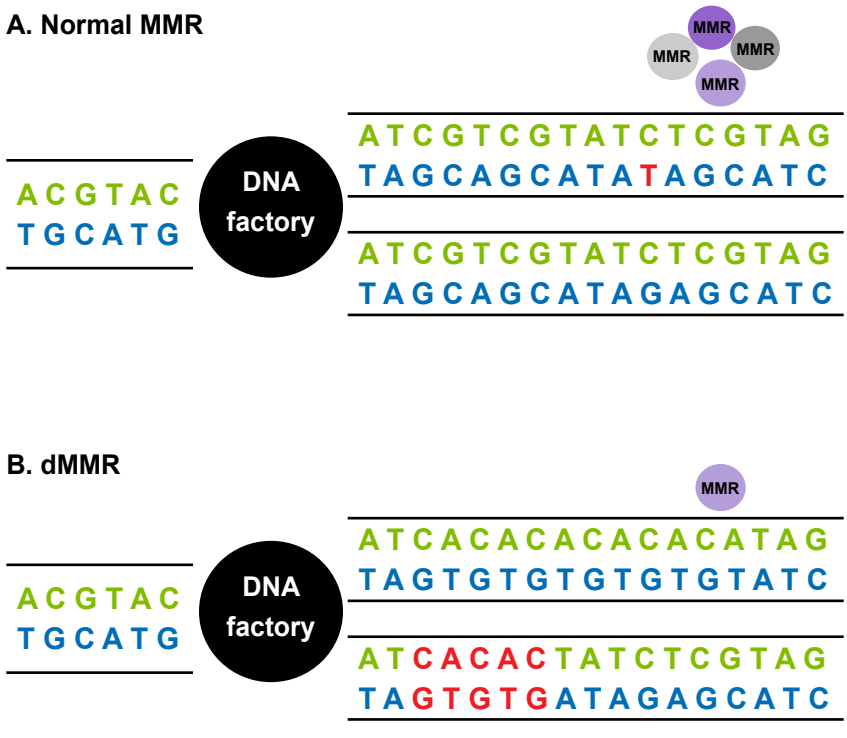
An IHC (**i**mmuno**h**isto**c**hemistry) panel is used to assess MMR proteins. It involves applying a chemical marker to cells then looking at them with a microscope. There are four types of MMR proteins. They are MLH1, MSH2, MSH6, and PMS2. If all are present, it is unlikely that any *MMR* gene is mutated.

If the MLH1 protein is missing, more testing should follow. The cancer may be tested for a *BRAF V600E* mutation or a modified *MLH1* gene. If a *BRAF* mutation or modified gene is present, you don't have Lynch syndrome. If not present or the other MMR proteins are missing, the cancer will be tested for *MMR* mutations to confirm Lynch syndrome.

Figure 8
MMR system

A. The four types of MMR proteins are present to correct DNA errors when copies of DNA are being made. An error has been made in the C-G pair. G has been replaced by T.

B. The MMR system is deficient. Some MMR proteins are missing. A DNA microsatellite has been shortened in the bottom DNA copy.



Review

- A medical history is a report of all health events in your lifetime. It will include questions about your family's health to help assess if you have a syndrome related to colon cancer. Such syndromes include Lynch syndrome and FAP.
- Your doctor will examine your body for signs of disease. He or she will touch parts of your body to see if anything feels abnormal.
- Blood tests may be done to look for signs of cancer spread to distant sites.
- Imaging tests allow your doctor to see how far the cancer has spread without cutting into your body.
- A needle biopsy may be done to test for cancer in distant sites.
- Molecular testing for MSI or missing MMR proteins is advised for all colon cancers. Testing for mutated *KRAS*, *NRAS*, and *BRAF* genes is advised for metastatic cancer.

"In spite of everything I have been through—a traumatic surgery, potential brain damage from my surgery, physical pain, doubt, fear, financial uncertainty and much more as a result of colon cancer—all of my good days still outweigh all of my bad days. I am here to fight the good fight for colorectal cancer research and awareness! We are strong!

–Roland
Survivor, Stage II

3
Overview of cancer treatments

In Part 3, the main treatment types for colon cancer are briefly described. Knowing what a treatment is will help you understand your treatment options listed in Parts 4 through 6. There is more than one treatment for colon cancer. Not every person will receive every treatment described in this chapter.

Surgery

Some colon cancers grow beyond the polyp and into the colon wall. In many of these cases, surgery is a key part of treatment. Your surgery may consist of more than one type. This section describes the types of surgery used for colon cancer.

Your treatment team will tell you how to prepare for and what to expect during surgery. You may need to stop taking some medicines to reduce the risk of severe bleeding. Eating less, changing to a liquid diet, or using enemas or laxatives will empty your colon for surgery. Right before surgery, you will be given general anesthesia.

Colectomy

A colectomy is a surgery that removes the part of the colon with cancer. **See Figure 9**. After the part is removed, the two ends of the remaining colon are often joined back together. They are either sewn or stapled together.

Before surgery, the cancer site may be marked with a tattoo. The tattoo allows your surgeon to find the cancer site after the polyp has been removed.

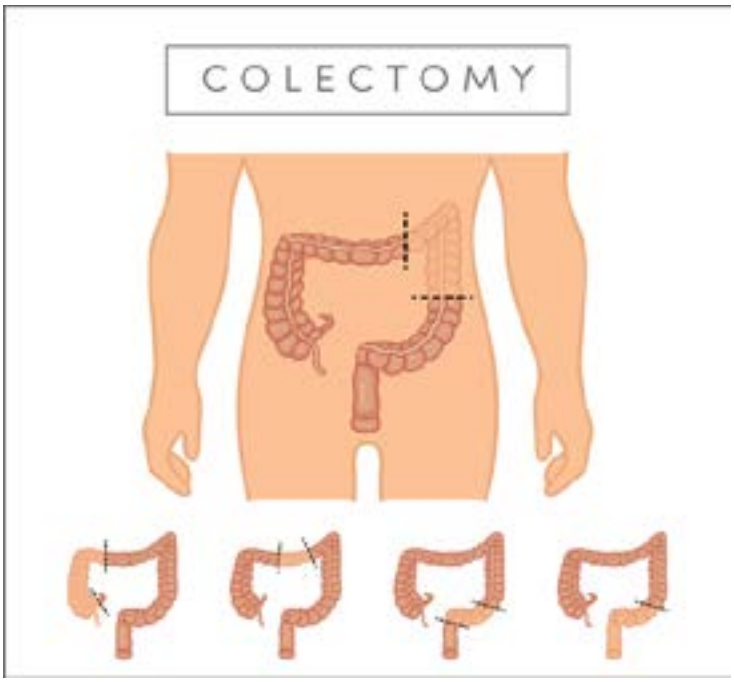


Figure 9
Colectomy

Many colon cancers are removed with a surgery called colectomy. This surgery removes the part of the colon that has cancer. Afterward, the two ends of the remaining colon are sewn or stapled back together.

Marking isn't always needed. For example, marking isn't done if the cancer site can be easily found.

A colectomy can be done with one of two methods. The open method removes tissue through a large cut in your abdomen. The minimally invasive method involves making a few small cuts. Tools are inserted through the cuts to see and remove part of your colon.

A colectomy can take 1 to 4 hours to complete. You may stay in the hospital for several days to recover. After surgery, you will be told what you can and can't eat to prevent discomfort and help healing.

Colostomy

To aid healing, you may have a colostomy, although most people do not need it. A colostomy connects a part of the colon to the outside of the abdomen. This creates an opening in your abdomen. Stool can pass through the opening. If a colostomy is done, it is usually for a short period of time. It is rare for a colostomy not to be removed.

Lymphadenectomy

A lymphadenectomy is a surgery that removes lymph nodes. It is done at the same time as the colectomy. At least 12 lymph nodes near to the cancer site should be removed for cancer testing. All nodes that look abnormal should be removed, too.

Metastasectomy

Surgery to remove a metastasis is called a metastasectomy. Not all metastatic disease can be treated with surgery. The methods of surgery for metastasectomy vary based on where the cancer has spread.

Side effects

Side effects are unplanned physical or emotional reactions to treatment. Surgery causes pain, swelling, and scars. Pain and swelling often fade away in the weeks following surgery. Scars from surgery don't fully fade away.

As with any surgery, there is a chance of complications. These include major blood loss, infection, heart attack, and blood clots. There can also be injury to nearby organs. Your surgical team will design care to prevent these risks.

Colectomy may cause certain side effects. Organs may push through weakened tissue (hernia). Scar tissue may block the colon. Food may leak out where the colon was reconnected.

Not all side effects of surgery are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better.

Chemotherapy

Chemotherapy, or “chemo,” includes drugs that disrupt the life cycle of cancer cells. The types of chemotherapy differ in the way they work. Some kill cancer cells by damaging their DNA or by disrupting the making of DNA. Others interfere with cell parts that are needed for making new cells. Thus, no new cells are made to replace dying cells. Chemotherapy can affect both cancer and normal cells.

Some chemotherapy drugs work when cells are in an active growth phase. **See Figure 10.** During the active growth phase, cells grow and divide to form a new cell. Chemotherapy that disrupts the growth phase works well for cancer cells that are growing and dividing quickly. Other chemotherapy drugs work in any growth or resting phase.

What to expect

Chemotherapy regimens used for colon cancer are listed in Guide 2. Sometimes, only one drug is used. Other times, more than one drug is used because drugs differ in the way they work. A combination regimen is the use of two or more chemotherapy drugs.

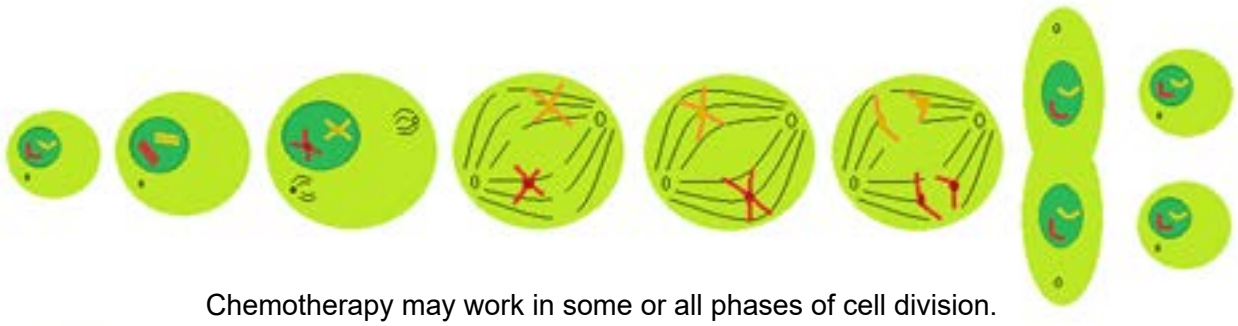
Most chemotherapy drugs for colon cancer are liquids that are injected into your body. They are almost always injected into a vein within your arm. A slow injection is called an infusion. Bolus injections are fast. Only capecitabine and trifluridine/tipiracil are in pill form.

Chemotherapy will enter your bloodstream. Once in the bloodstream, it can travel throughout your body to treat cancer. Doctors use the term “systemic” when talking about a cancer treatment for the whole body.

Chemotherapy received by HAI (**h**epatic **a**rterial **i**nfusion) differs. Chemotherapy is given through a port or pump within the artery supplying blood to the liver. If a pump is used, it is placed within the artery

Figure 10
Chemotherapy and the cell cycle

A cell goes through many changes to divide into two cells. Science has grouped these changes into 7 main phases. There may be another phase of rest, too. Some chemotherapy drugs work in any phase. Other chemotherapy drugs work in one or two growth phases.



Chemotherapy may work in some or all phases of cell division.

during surgery. HAI may be a treatment option for colon cancer in the liver. NCCN experts advise that HAI should only be done at treatment centers with much experience in this method.

Chemotherapy is given in cycles of treatment days followed by days of rest. The cycles vary in length depending on which drugs are used. Common cycles are 14 or 21 days long. Giving chemotherapy in cycles gives your body a chance to recover after receiving chemotherapy. If you will have chemotherapy, ask your doctor how many cycles will be given and how many days of treatment there are within a cycle.

Side effects

Side effects differ among people. Some people have many side effects. Other people have few. Some side effects can be very serious while others can be unpleasant but not serious. Most side effects appear shortly after treatment starts and will stop after treatment. However, other side effects are long-term or may appear years later.

Side effects of chemotherapy depend on the drug type, amount taken, length of treatment, and the person. In general, side effects are caused by the death of fast-growing cells. These cells are found in the hair follicles, gut, mouth, and blood. Thus, common side effects of chemotherapy include

Guide 2. Chemotherapy types

Single agent or combination	Generic name	Brand name
5-FU/LV	5-FU = fluorouracil	–
	LV = leucovorin*	–
Capecitabine	Capecitabine	Xeloda®
CAPEOX	CAPE = capecitabine	Xeloda®
	OX = oxaliplatin	Eloxatin®
FOLFIRI	FOL = leucovorin*	–
	F = fluorouracil	–
	IRI = irinotecan	Camptosar®
FOLFOX	FOL = leucovorin*	–
	F = fluorouracil	–
	OX = oxaliplatin	Eloxatin®
FOLFOXIRI	FOL = leucovorin*	–
	F = fluorouracil	–
	OX = oxaliplatin	Eloxatin®
	IRI = irinotecan	Camptosar®
Irinotecan	Irinotecan	Camptosar®
Trifluridine + tipiracil	Trifluridine + tipiracil	Lonsurf®

*Levoleucovorin can be used instead of leucovorin

low blood cell counts, not feeling hungry, nausea, vomiting, diarrhea, hair loss, and mouth sores.

Oxaliplatin causes a very unique side effect. It can cause a short-lived and sometimes painful sensitivity in areas exposed to cold. Examples of these areas are your mouth when drinking cold liquids and your fingers when holding a cold object. If more oxaliplatin is used over time, loss of sensation and tingling in fingers and toes can occur. It can take months or years for these symptoms to resolve. You might end up having a permanent loss of sensation in your feet after long-term oxaliplatin-based treatment (sensory neuropathy).

Not all side effects of chemotherapy are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better. There are also ways to prevent some side effects.

Targeted therapy

Targeted therapy is a class of drugs that stops the action of molecules that help cancer cells grow. It is less likely to harm normal cells than chemotherapy. Targeted therapy for colon cancer targets either the VEGF (**v**ascular **e**ndothelial **g**rowth **f**actor) or EGFR (**e**pidermal **g**rowth **f**actor **r**eceptor) pathway.

Targeted therapy used for colon cancer is listed in Guide 3. Many of these are also called biologic therapies because they are antibodies. Antibodies are Y-shaped proteins. Some are made by your body. The ones used for colon cancer were made in a lab.

Targeted therapies are briefly described next. Some side effects are listed. Ask your treatment team for a full list of common and rare side effects. In Parts 4 through 6, information on who should receive these drugs is provided.

Guide 3. Targeted therapy

Generic (chemical) name	Brand name (sold as)
Bevacizumab	Avastin®
Cetuximab	Erbitux®
Panitumumab	Vectibix®
Ramucirumab	Cyramza®
Regorafenib	Stivarga®
Ziv-aflibercept	Zaltrap®

VEGF pathway

Cancer cells need the food and oxygen in blood to grow. Cancer cells get blood from blood vessels that have grown into the tumor. VEGF is one of the molecules that triggers the growth of these blood vessels.

VEGF is made by cancer cells. It travels from cancer cells to endothelial cells. Endothelial cells form blood vessels.

Surface receptors are proteins within cell membranes that extend from the inside to the outside of cells. VEGF attaches to surface receptors on the outside of endothelial cells. Attachment of VEGF to receptors triggers growth signals. There are four medicines used to stop the growth signals caused by VEGF.

Bevacizumab

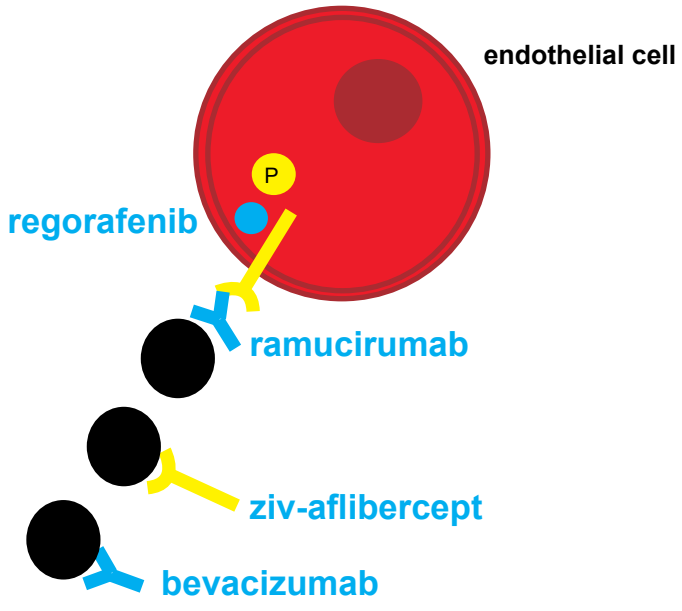
Bevacizumab attaches to VEGF before it attaches to receptors on endothelial cells. **See Figure 11**. As a result, VEGF can't attach to receptors. No growth signals caused by VEGF are started.

Bevacizumab is given by infusion. It takes about 90 minutes to get the first dose and 30 minutes for later doses. Bevacizumab is always given with chemotherapy. It is given every two or three weeks depending on the chemotherapy.

Common side effects of bevacizumab are high blood pressure, diarrhea, and feeling tired and weak. You might also have nosebleeds, shortness of breath, nausea, and vomiting. Rare but serious side effects include stroke, heart attack, kidney damage, holes in the intestine, and bleeding within the body.

Figure 11
VEGF targeted therapy

Cancer cells need blood to grow. They send VEGF to endothelial cells to start the growth of blood vessels. Regorafenib stops growth signals within endothelial cells. Ramucirumab blocks VEGF from attaching to receptors. Ziv-aflibercept traps VEGF by being a receptor decoy. Bevacizumab disables VEGF from attaching to receptors.



Ramucirumab
Ramucirumab attaches to VEGF receptors on the outside of endothelial cells. This blocks VEGF from attaching. No growth signals caused by VEGF are started.

Ramucirumab is given by infusion. It takes 60 minutes to receive the full dose. Ramucirumab is always given with chemotherapy. It is given every two weeks on the first day of chemotherapy.

Common side effects of ramucirumab are high blood pressure and diarrhea. Serious side effects include bleeding, blood clots, holes in the gut, abnormal passage between body parts, and slow wound healing.

Regorafenib
Regorafenib attaches to VEGF receptors on the inside of endothelial cells. This blocks growth signals from the receptor. Regorafenib may also attach to surface receptors within cancer cells and stop growth signals.

Regorafenib is made as a pill that is taken once a day. However, it is taken in cycles consisting of treatment days followed by a period of no treatment. The cycle for regorafenib consists of 3 weeks of treatment then 1 week of no treatment. The cycle is then repeated.

Common side effects of regorafenib include feeling tired or week, fever, and diarrhea. Your hands and feet may become red and have pain. This is called hand-foot skin reaction. It is important to remove calluses on hands and feet before starting regorafenib. Rare but serious side effects of regorafenib include severe liver damage, heart attack, and blindness.

Ziv-aflibercept
Ziv-aflibercept works by acting as a decoy. VEGF thinks ziv-aflibercept is a surface receptor and attaches to it. Thus, ziv-aflibercept traps VEGF so it is unable to bind to the real receptor. Hence its other name is VEGF-trap. By trapping VEGF, growth signals caused by VEGF within endothelial cells won't be started.

Ziv-aflibercept is given by infusion in about 1 hour every two weeks. Ziv-aflibercept is given with chemotherapy.

Common side effects include diarrhea, mouth sores, high blood pressure, feeling tired, voice changes, and nose bleeds. You may also experience blood clots, urinary tract infection, and darkening of the skin. Rare but serious side effects include stroke, holes in the intestine, bleeding in the brain or lungs, and kidney damage.

EGFR pathway

Cell growth is started by growth signals. EGFR is one of the surface receptors in colon cancer cells that can trigger growth signals. When EGF (**e**pidermal **g**rowth **f**actor) attaches to EGFR, the chemical pathway that sends growth signals is turned on.

Some people with colon cancer have abnormal changes in their gene that controls EGFRs. These changes cause the cancer cells to have too many EGFRs. For a small group of people, the EGFRs may be overactive.

With too many or overactive EGFRs, new cancer cells form quickly. There are two medicines used to block the growth signals from EGFRs. **See Figure 12**. These medicines don't work if the cancer cells have mutations in *KRAS* or *NRAS* genes.

Cetuximab
Cetuximab treats colon cancer by attaching to the ends of EGFRs that are outside of the cell. Thus, EGF is blocked from attaching and triggering growth signals. Cetuximab also attracts immune cells that help to kill the cancer cells.

Cetuximab is given by infusion, usually once a week or every other week. It may take 2 hours to receive the first dose. Later doses will take only 1 hour. Cetuximab may be given with or without chemotherapy.

Some people have an infusion reaction to cetuximab. Symptoms of a reaction include chills and fever. If you have a reaction, you will be given cetuximab more slowly.

Besides a reaction, common side effects of cetuximab include an acne-like rash, infections, mouth sores, and feeling tired and weak. Other possible side effects are nausea, diarrhea, trouble sleeping, swelling of feet, and lower blood magnesium levels. Rare but serious side effects include heart, lung, eye, or kidney damage.

Panitumumab

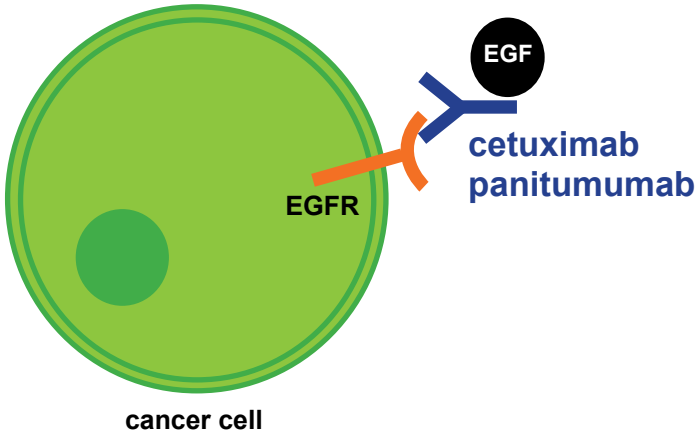
Panitumumab is the same type of drug as cetuximab. However, it does somewhat differ from cetuximab in its structure. It works much like cetuximab by attaching to EGFRs and attracting immune cells.

Panitumumab is given by IV infusion over 1 hour every other week. It may be given with or without chemotherapy.

Panitumumab rarely causes infusional reactions. Common side effects include skin rash, diarrhea, feeling tired, constipation, and lower blood magnesium levels. Rare but serious side effects include lung and eye damage and blood clots in the lungs.

Figure 12
EGFR targeted therapy

Some colon cancers consist of cells with too many or overactive EGFRs. EGFRs trigger growth signals with cancer cells. Cetuximab and panitumumab block EGF from attaching to EGFR and turning it on.



Radiation therapy

Radiation therapy uses high-energy, highly focused rays to treat cancer. The rays damage DNA. This either kills the cancer cells or stops new cancer cells from being made.

Radiation therapy is not often used to treat colon cancer. You may receive radiation therapy as part of a clinical trial. Otherwise, Parts 4 and 5 explain when radiation therapy is an option.

External radiation

Most often, EBRT (**e**xternal **b**eam **r**adiation **t**herapy) is the method used to treat colon cancer. This method delivers radiation from outside your body using a large machine. **See Figure 13**.

Figure 13
External beam radiation therapy

Radiation therapy is often delivered from a large machine. The rays pass through skin and travel to the tumor. Healthy tissue is protected using modern types of treatment.

The radiation passes through your skin and other tissue to reach the tumor.

A planning session is needed to receive the best treatment. This session is called simulation. First, you will be guided and adjusted into the position needed for treatment. After this, pictures of the cancer sites will be made with an imaging test.

Using the pictures, your radiation team will plan treatment. A team consists of doctors, medical physicists, and technical experts in radiation planning. They will plan the best dose, number and shape of radiation beams, and number of treatments.

Conformal techniques are used for colon cancer. These techniques shape the radiation dose to the cancer site to spare healthy tissue. However, some healthy tissue still gets radiated. The radiation dose is shaped with computer software and hardware added to the machine. The types of conformal radiation include:

- 3D-CRT (**three-d**imensional **c**onformal **r**adiation **t**herapy) delivers, from different angles, a photon beam that matches the shape of the tumor. Treatment is completed in about 6 weeks.
- IMRT (**i**ntensity-**m**odulated **r**adiation **t**herapy) is a form of 3D-CRT that further modifies the beam's intensity during treatment. Treatment is completed in about 6 weeks. IMRT should be used only for a second treatment with radiation or for cancer in an uncommon site.
- SBRT (**s**tereotactic **b**ody **r**adiation **t**herapy) treats cancer with very precise, high-dose photon beams. Receiving SBRT is much like other conformal techniques except treatment is finished in about 5 visits. At this time, SBRT should only be used to treat colon cancer in the liver or lungs.

During treatment, you will lie on a table as you did for simulation. Devices may be used to keep you from moving. This helps to target the tumor. Radiation beams are aimed with help from ink marks on your skin or marker seeds in the tumor.

You will be alone in the treatment room. A technician will operate the machine from a nearby room. He or she will be able to see, hear, and speak with you at all times. As treatment is given, you may hear noises. You will not see, hear, or feel the radiation. One session can take less than 10 minutes.

Intraoperative radiation

IORT (**i**ntra**o**perative **r**adiation **t**herapy) delivers radiation inside your body at the time of an operation. Different methods can be used. However, the usual method involves a device that is placed where the tumor was. The radiation kills remaining cancer cells in the tissue that was near the tumor.

IORT is a one-time treatment that is given while you are still asleep. It can deliver a radiation dose similar to EBRT or deliver extra radiation. This extra radiation is called a boost. IORT uses radiation made of electrons. Electrons do not travel far and are less likely to harm the tissue beneath the treatment site.

Brachytherapy

Some cancer centers do not have an IORT machine. In this case, a boost of radiation can be given with EBRT or brachytherapy. Brachytherapy delivers radiation through radioactive objects that are placed where the tumor was. The objects remain in your body for a short period of time following surgery. Brachytherapy is rarely used for colon cancer.

Side effects

Side effects from radiation therapy differ among people. Factors like method, treatment site, radiation dose, and length of treatment play a role. However, many people feel tired (fatigue) no matter the radiation method or site.

When EBRT is used, skin damage is also common right after treatment. Your skin will heal shortly after treatment ends. You may also have short-term hair loss, but only where treated.

Chest radiation can cause a dry cough or a sensation of a lump when you swallow. Radiation near your belly can cause nausea and maybe vomiting. When given between your hip bones, radiation can cause frequent bowel movements. Your stool may be loose (diarrhea) and you may have cramps or pain in your abdomen.

IORT and brachytherapy can cause side effects like EBRT. You may feel nauseated and may vomit. Frequent bowel movements and urination may occur.

Late side effects of radiation can happen. Again, the effects depend on the treatment site. Examples include lung scarring, heart disease, infertility, and second cancers.

Not all side effects of radiation are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better. There are also ways to prevent some side effects.

Ablation

Ablation destroys small tumors with little harm to nearby tissue. It is done by either an interventional radiologist or a surgeon. It isn't used often for colon cancer.

Doctors sometimes consider ablation for metastases. Most often it is considered for colon cancer that has spread to the liver or lung. Ablation is only an option if all the first sites of cancer can be treated with this method, with or without surgery or radiation.

There is more than one way to "ablate" a tumor. Cryoablation kills cancer cells by freezing them with liquid nitrogen. Radiofrequency and microwave ablation kills cancer cells with high-energy radio waves. A probe placed into the tumor emits the waves. The probe will be guided into place with help from an imaging test and will be removed when treatment is done.

Embolization

Embolization treats liver tumors with chemotherapy or radioactive beads. It is done by an interventional radiologist. A catheter will be inserted into an artery in your leg and guided to the tumor. Once in place, the beads will be inserted into the blood vessel.

The beads block blood flow to the tumor. Without blood, the cancer cells "starve" and die. The chemotherapy or radiation further damage the cancer cells and cause the tumor to shrink.

This treatment is a type of arterially directed catheter therapy. If radiation beads are used, it's called selective internal radiation therapy. Embolization is an option for some people with liver metastases. It is given when chemotherapy is not an option.

Clinical trials

One of your treatment choices may be to join a clinical trial. Joining a clinical trial is strongly supported. NCCN believes that you will receive the best management in a clinical trial.

New tests and treatments aren't offered to the public as soon as they're made. They first need to be studied. A clinical trial is a type of research that studies a test or treatment in people.

Clinical trials study how safe and helpful tests and treatments are for people. When found to be safe and helpful, they may become tomorrow's standard of care. Because of clinical trials, the tests and treatments in this book are now widely used to help people with colon cancer. Future tests and treatments that may have better results than today's treatments will depend on clinical trials.

New tests and treatments go through a series of clinical trials. These trials aim to ensure they're safe and work. Without clinical trials, there is no way to know if a test or treatment is safe or helpful. Clinical trials have four phases. Some examples of the four phases for treatment are:

- **Phase I trials** aim to find the safest and best dose of a new drug. Another aim is to find the best way to give the drug with the fewest side effects. These trials often involve about 20 people.
- **Phase II trials** assess if a drug works for a specific type of cancer.
- **Phase III trials** compare a new drug to a standard treatment. These trials often involve hundreds or thousands of people.
- **Phase IV trials** test drugs approved by the U.S. FDA (**F**ood and **D**rug **A**dministration) to learn more about side effects with long-term use.

Joining a clinical trial has benefits. First, you'll have access to the most current cancer care. However, please note that it is unknown how well new treatments work if at all. Second, you will receive the best management of care. Third, the results of your treatment—both good and bad—will be carefully tracked. Fourth, you may help other people who will have cancer in the future.

Clinical trials have risks, too. Like any test or treatment, there may be side effects. Also, new tests or treatments may or may not improve your health. In fact, your health may worsen during a trial. Other downsides may include more hospital trips, paperwork, and extra costs for you.

To join a clinical trial, you must meet the conditions of the study. Patients in a clinical trial are often alike in terms of their cancer and general health. Thus, if patients improve, it's because of the treatment and not because of differences between them.

To join, you'll need to review and sign an informed consent form. This form describes the study in detail. The study's risks and benefits should be described and may include others than those described above.

Ask your treatment team if there is an open clinical trial that you can join. There may be clinical trials where you're getting treatment or at other treatment centers nearby. You can also find clinical trials through the websites listed in Part 7.

Review

- A colectomy is an operation that removes the part of the colon with cancer. A lymphadenectomy is the removal of lymph nodes, and a metastasectomy is the removal of metastases.
- Chemotherapy stops cancer cells from completing their life cycle so they can't increase in number.
- One type of targeted therapy stops the growth of new blood vessels into colon tumors. Without blood, cancer cells starve and die. A second type of targeted therapy for colon cancer stops the cancer cells from receiving certain growth signals.
- Radiation kills cancer cells or stops new cancer cells from being made. It isn't often used to treat colon cancer.
- Ablation destroys small tumors by freezing or burning them. It isn't often used for colon cancer.
- Embolization treats cancer by blocking blood flow to the tumor and damaging cancer cells with chemotherapy or radiation. It is used for a very select group of people.
- Clinical trials give people access to new tests and treatments that otherwise can't usually be received. These new tests and treatments may, in time, be approved by the FDA.

4
Treatment guide: Nonmetastatic cancer

Part 4 is a treatment guide for colon cancer that hasn't spread to distant sites. The cancer is confined within the colon, has grown to nearby structures, or has spread to nearby lymph nodes. Treatment options are partly based on cancer stage.

Stage I

Guide 4 lists the treatment options for tumors rated as T1. These tumors haven't grown beyond the second layer of the colon wall. They are sometimes called "polyps with cancer" because the cancer hasn't grown far.

Some people with T1 tumors will need treatment. Treatment is based on the shape of the polyp and whether cancer will likely return after a polypectomy. Shapes of polyps are shown in **Figure 14**. The cancer is more likely to return if these high-risk features are present:

- **Fragmented specimen** is a tumor that was removed in pieces.
- **Positive surgical margin** is cancer within the normal-looking tissue around the tumor.
- **Unknown surgical margin** is unclear results of the normal-looking tissue around the tumor.
- **Cancer grade 3 or 4** means cancer cells don't look much like normal cells.
- **Angiolymphatic invasion** is cancer spread into the tumor's lymph and blood vessels.
- **Tumor budding** is a group of 5 or fewer cancer cells separate from the main tumor.

A polypectomy likely removed all the cancer if you had a pedunculated polyp without high-risk features. No more treatment is advised. You can start follow-up testing.

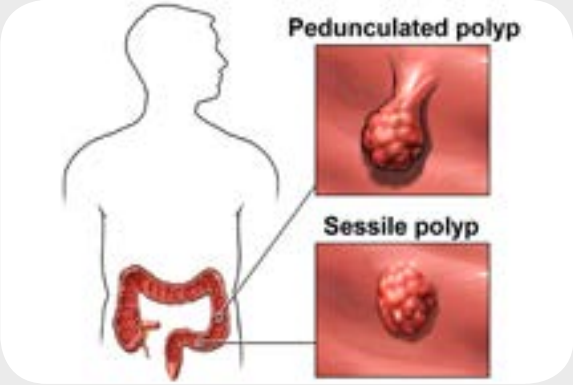
For a sessile polyp without high-risk features, there are two options if the polyp was fully removed. You may start follow-up testing. Surgery is also an option.

Guide 4. Treatment for T1 tumors

Test results	What are the options?
Pedunculated polyp without high-risk features	• Start follow-up testing
Sessile polyp without high-risk features	• Start follow-up testing • Colectomy + lymphadenectomy
Any polyp with high-risk features	• Colectomy + lymphadenectomy

Figure 14
Shapes of polyps

Treatment for stage I, T1 tumors is partly based on the shape of the polyp. A pedunculated polyp has a stalk and round top. A sessile polyp doesn't have a stalk.



Sessile polyps have worse outcomes than other polyps when surgery isn't received.

Either type of polyp may have high-risk features. In this case, surgery is advised. The part of the colon with cancer and some lymph nodes should be removed.

Guide 5 lists the treatment options for tumors rated as T2. These tumors haven't grown beyond the third layer of the colon wall. Treatment is needed.

If you are able to have surgery, a colectomy and lymphadenectomy are advised. It is very rare that surgery can't be done. In this case, sometimes chemotherapy is given if you're healthy enough. Radiation therapy may be added.

In very rare cases, a T2 tumor has grown so large that it blocks the flow of stool. There are four options when there is a blockage. One option is a colectomy that unblocks your gut. Another option is removal of the cancer and a diversion within one operation. A diversion is a surgery that attaches the colon to the surface of the abdomen, and a "bag" is needed. A third option is a diversion followed by a second operation to remove the cancer. Last, some people can get a stent followed by a second operation to remove the cancer.

The tissue that is removed from your body will be sent to a pathologist. The pathologist will assess how far the cancer has grown within the colon wall. He or she will also test for cancer in your lymph nodes. If the cancer stage doesn't change, you will not need more treatment. If the cancer is upstaged to stage II or III, read Guide 9. This guide lists what further treatment is advised.

Guide 6 lists follow-up testing for polyps with cancer. Follow-up testing is started when there are no signs of cancer after treatment. It can be helpful for finding new cancer growth early.

A colonoscopy is recommended 1 year after treatment has ended. If results are normal, the next colonoscopy should be received in 3 years and then every 5 years. If an advanced adenoma is found, your next colonoscopy will be needed within 1 year. Advanced adenomas include polyps with a ruffled structure (villous), a polyp larger than the width of an AAA battery (>1 cm), or a polyp with pre-cancerous cells (high-grade dysplasia).

Guide 5. Treatment for T2 tumors

Surgery status	What are the options?
The tumor can be treated with surgery and isn't blocking the gut	• Colectomy + lymphadenectomy
The tumor can be treated with surgery and is blocking the gut	• Colectomy + lymphadenectomy • Colectomy + lymphadenectomy + diversion • Diversion followed by colectomy + lymphadenectomy • In some cases, stent followed by colectomy + lymphadenectomy

Guide 6. Follow-up care

Type of care	How often is this care needed?
Colonoscopy	• At 1 year after treatment ◦ If no advanced adenoma, repeat in 3 years ▪ If results are normal, then repeat every 5 years ◦ If advanced adenoma, repeat in 1 year

Stages II and III

Guide 7 lists the options for neoadjuvant treatment for stages II and III cancers. The aim of this treatment is to shrink a tumor so it can be fully removed during surgery. Less invasive cancers are often easier to remove.

Neoadjuvant treatment is based on the T stage. Tumors that are rated as T1, T2, T3, and T4a haven't grown through the colon wall to nearby organs. For these tumors, neoadjuvant treatment isn't advised.

Tumors rated as T4b have grown through the colon wall to nearby structures. In this case, your doctor may want to use chemotherapy before surgery. FOLFOX or CAPEOX are advised.

Guide 8 lists the options for primary treatment. Primary treatment is the main treatment used to rid your body of cancer. Treatment options are based on whether the tumor can be removed.

Surgery is an option

If you are able to have surgery, a colectomy and lymphadenectomy are advised. In rare cases, a

Guide 7. Neoadjuvant treatment

T stage	What are the options?
Colon tumors haven't grown to nearby sites (T1–T4a)	• Start primary treatment
Colon tumors have grown to nearby sites (T4b)	• Start primary treatment • FOLFOX or CAPEOX

Guide 8. Primary treatment

Surgery status	What are the options?
The tumor can be treated with surgery and isn't blocking the gut	• Colectomy + lymphadenectomy
The tumor can be treated with surgery and is blocking the gut	• Colectomy + lymphadenectomy • Colectomy + lymphadenectomy + diversion • Diversion followed by colectomy + lymphadenectomy • In some cases, stent followed by colectomy + lymphadenectomy
The tumor can't be treated with surgery	• Treatment listed in Part 6 • Infusional 5-FU + radiation therapy • Capecitabine + radiation therapy • Bolus 5-FU/LV + radiation therapy

tumor has grown so large that it blocks the flow of stool. There are four options when there is a blockage.

One option is a colectomy that unblocks your gut. Another option is removal of the cancer and a diversion within one operation. A diversion is a surgery that attaches the colon to the surface of the abdomen, and a “bag” is needed. A third option is a diversion followed by a second operation to remove the cancer. Last, some people can get a stent followed by a second operation to remove the cancer.

Pathology

The tissue that will be removed from your body will be sent to a pathologist. The pathologist will assess how far the cancer has grown within the colon wall. He or she will also test for cancer in your lymph nodes. Based on test results, a pathologic stage will be assigned.

Surgery isn’t an option

It is very rare but you may be unable to have surgery. Surgery may not be possible because of where the cancer is. Some health issues also exclude surgery.

In this case, sometimes chemotherapy is given if you are healthy enough. The chemotherapy listed in Part 6 may be used. Other preferred options are radiation therapy with either infusional 5-FU or capecitabine. If neither is an option, a third option is bolus 5-FU/LV with radiation therapy.

For very invasive tumors, chemotherapy may shrink the tumor enough for surgery. IORT may be added. If you’re still unable to have surgery, you may be treated with more cycles of chemotherapy.

Guide 9 lists the options for adjuvant treatment for stages II and III cancers. Adjuvant treatment is given when all visible cancer has been removed. The aim of this treatment is to kill any unseen cancer cells. If adjuvant treatment is right for you, receive it as soon as possible for the best results.

Deciding factors

Options for adjuvant treatment are partly based on pathologic stage. Stage IIA cancer has grown into the fourth layer of the colon wall. Stage IIB cancer has grown through the colon wall but not to nearby structures. Stage IIC cancer has grown to nearby structures. Stage III cancer has spread to nearby lymph nodes.

In some cases, options are also based on MMR status and risk level. The MMR system is explained in Part 2. A high-risk level means the cancer is more likely to return.

The risk level is high if these conditions are met:

- Positive surgical margin is cancer within the normal-looking tissue around the tumor.
- Close surgical margin is cancer near the normal-looking tissue around the tumor.
- Unknown surgical margin is an unclear assessment of the normal-looking tissue around the tumor.
- Cancer grade 3 or 4 means the cancer cells don't look much like normal cells.
- Angiolymphatic invasion is cancer spread into the tumor's lymph and blood vessels.
- Perineural invasion is cancer spread around or into the nerves.

Guide 9. Adjuvant treatment

Pathologic stage	MMR status	Risk level	What are the options?
Stage IIA	MSI-H or dMMR	Any level	• Start follow-up testing
Stage IIA	MSS, MSI-L, or normal MMR	Not high risk	• Clinical trial • Start follow-up testing • Consider capecitabine or 5-FU/LV
Stage IIA	MSS, MSI-L, or normal MMR	High risk	• Capecitabine or 5-FU/LV • FOLFOX or CAPEOX • Clinical trial • Start follow-up testing
Stage IIB	Any status	Any level	
Stage IIC	Any status	Any level	
Stage III	Any status	Any level	• FOLFOX or CAPEOX • Capecitabine • 5-FU/LV

- Limited lymphadenectomy means fewer than 12 lymph nodes were examined.
- Bowel obstruction means the tumor has grown large enough to block the gut.
- Localized perforation is the presence of holes in the colon caused by the tumor.

Treatment options

If stage II, talk to your doctor about the pros and cons of treatment. It is important to know that chemotherapy may have little, if any, benefit. Treatment decisions should be based on science, side effects, cancer features, and your wishes.

If a stage II tumor is MSI-H or dMMR, no further treatment is advised. The outlook (prognosis) of the cancer is good. Also, 5-FU chemotherapy will not help. You can start follow-up testing.

There are three options for stage IIA cancer that isn't MSI-H or dMMR and without high-risk features. First, you can enroll in a clinical trial. Second, you can start follow-up testing. Third, you can talk with your doctors about starting chemotherapy. Capecitabine alone or 5-FU/LV is advised.

High-risk stage IIA without MSI-H or dMMR, stage IIB, and stage IIC cancers have four options. Capecitabine or 5-FU/LV is one option. FOLFOX or CAPEOX is another option. A T4 tumor that has grown to a nearby structure may be treated with both radiation and chemotherapy. The third option is to join a clinical trial. A fourth option is to start follow-up testing.

For stage III, chemotherapy is advised. The risk for cancer returning after treatment is high. FOLFOX or CAPEOX is often given for stage III. If oxaliplatin is not right for you, other options are capecitabine alone or 5-FU/LV.

"I always tell people going through treatment two things: to get themselves a "chemo buddy" like a stuffed animal. It's not only therapeutic for them, but other patients and even the staff! And I also tell people to let others help you with things so you can focus on getting through the treatment!

–Shaye
Survivor, Stage III

Guide 10 lists important follow-up care for stages II and III cancer. Follow-up care starts when there are no signs of cancer after treatment. It is also called survivorship care. This care should address your whole health and well-being.

Your cancer doctor and primary doctor should work together to help you. Each doctor can have a role in survivorship. Talk with your doctors about the care you want and need so you get the best plan.

Cancer tests

A medical history and physical exam are advised. Get this care every 3 to 6 months for 2 years. If results are normal for 2 years, repeat care every 6 months for another 3 years.

CEA blood tests are mainly used to detect the return of cancer. If a recurrence is unlikely, your doctor may not order this test. CEA levels should be tested every 3 to 6 months for 2 years. If results are normal for 2 years, get tested every 6 months for another 3 years.

CT scans may help find metastases. Thus, scans of your chest, abdomen, and pelvis are advised. Get these scans every 6 to 12 months for a total of 5 years. CT should be done with both IV and oral contrast.

CT images may be unclear or not possible. In this case, MRI of the abdomen and pelvis with non-contrast CT of the chest is an option. PET/CT is not advised.

Guide 10. Follow-up care

Type of care	How often is this care needed?
Medical history and physical exam	• Every 3–6 months for 2 years ◦ If normal, then repeat every 6 months for 3 years
CEA blood test	• Every 3–6 months for 2 years ◦ If normal, then repeat every 6 months for 3 years
CT of chest, abdomen, pelvis	• Every 6–12 months for up to 5 years
Colonoscopy	• If no prior total colonoscopy, 3–6 months after treatment • If prior total colonoscopy, 1 year after treatment ◦ If no advanced adenoma, repeat in 3 years ▪ If results are normal, then repeat every 5 years ◦ If advanced adenoma, repeat in 1 year
Side effect care	• As needed
Prevent and screen for other diseases	• Follow guidelines
Help for healthy lifestyle	• As needed

Ongoing colonoscopies are also part of follow-up care. You may never have had a total colonoscopy if your gut was blocked. If so, get a colonoscopy within 3 to 6 months after treatment. If you had a total colonoscopy before, get tested 1 year after treatment.

You'll need a colonoscopy less often if results are normal. The next test is advised in 3 years. If these results are normal, get tested every 5 years.

If an advanced adenoma is found, another colonoscopy within 1 year is advised. Advanced adenomas include polyps with a ruffled structure (villous), a polyp larger than the width of an AAA battery (>1 cm), or a polyp with pre-cancerous cells (high-grade dysplasia).

Side effect care

You may still have some side effects when follow-up care is started. Ask your cancer doctor how long they may last. Some side effects may appear months or years after treatment has ended. Ask your doctor what's your chance that you'll get these late effects.

There may be ways to help relieve side effects. There are medicines and other methods to decrease diarrhea. A medicine called duloxetine may help painful neuropathy. Fatigue may be helped with exercise or methods to conserve energy. Ask your doctor about other ways to treat side effects.

Other care

It's important to take care of other health issues besides colon cancer. Take steps to prevent or detect other diseases early. Such steps can include getting immunizations like the flu shot.

Cancer screening is also important. Get a skin cancer exam. Ladies—learn how to do a breast self-exam. A mammogram may also be needed. Men—it may be time to get screened for prostate cancer.

Start or keep a healthy lifestyle. Limit your alcohol use. Quit smoking. Protect yourself from the sun. Be at a healthy weight. Eat healthfully. Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids.

Many people benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Review

- Stage I colon cancer has grown into the second layer of the colon wall (T1 tumors) or into the third layer (T2 tumors). Some T1 tumors may not need treatment after a polypectomy. Otherwise, T1 and T2 tumors may be treated with colectomy and lymphadenectomy.
- Surgery is advised for stages II and III colon cancer if you are able and willing to have it. You may receive chemotherapy before surgery if you have a T4b tumor. Chemotherapy after surgery may not be helpful for stage II cancers but is helpful for stage III.
- If you can't have surgery, chemotherapy is an option.
- Follow-up care is started when there are no signs of cancer. It includes tests to look for any new cancer and help for side effects. It also includes help to prevent or detect other diseases.

5
Treatment guide: Metastatic disease

5 Metastatic disease

Part 5 is a treatment guide for colon cancer that has spread to the liver or lungs but not elsewhere. Treatment options are partly based on whether the metastasis was found at diagnosis or recurrence. Treatment for other metastases is discussed in Part 6.

The spread of cancer to distant sites—metastatic disease—occurs in at least half of people with colon cancer. Colon cancer most often spreads to the liver. Among every 100 people with colon cancer, 20 to 34 people will have liver metastases at diagnosis. Most options for liver metastases also apply to lung metastases.

"What was the one thing I needed most during those 10 awful days after diagnosis? INFORMATION—Solid, easy-to-understand information about treatment options, how to cope with chemotherapy, radiation, depression, anxiety, family—the list goes on. And I needed someone to talk to who understood my situation.

–Elaine
Survivor, Stage IV

Metastases at diagnosis

This section explains treatment options for metastases found at diagnosis. These cancers are stage IV. Options for colon cancer that can be treated with surgery are explained first. However, most people with metastases can't have surgery. If you can't have surgery, treatment options are explained on page 50.

Guide 11 presents surgical options for liver or lung metastases at diagnosis. Surgery is only an option if 1) all tumors can be fully removed and 2) your liver won't be too small after surgery.

To enlarge your liver, you may receive portal vein embolization. Portal vein embolization is the blocking of the blood vessel to the liver tumor. This blockage causes the healthy part of the liver to grow larger. This procedure will be done before surgery.

Surgery with chemotherapy is advised to treat metastases. The best order of chemotherapy and surgery is unknown. Thus, three options are given.

Option 1

Option 1 starts with surgery. Surgery may consist of a colectomy and metastasectomy. They can be done together during one operation or apart in two operations. Local therapy to the liver or lung may be added.

Instead of metastasectomy, local therapy with colectomy may be an option. Local therapy includes ablation and SBRT. However, NCCN experts prefer metastasectomy over local therapy.

Guide 11. Surgical options

Option 1

Primary treatment	Adjuvant treatment
• Colectomy + metastasectomy ± local treatment • Colectomy + local treatment	• FOLFOX or CAPEOX • Capecitabine or 5-FU/LV

Option 2

Neoadjuvant treatment	Primary treatment	Adjuvant treatment
• FOLFOX or CAPEOX • FOLFIRI	• Colectomy + metastasectomy	• FOLFOX or CAPEOX • Capecitabine or 5-FU/LV

Option 3

Primary treatment	Adjuvant treatment	Primary treatment	Adjuvant treatment
• Colectomy	• FOLFOX or CAPEOX • FOLFIRI	• Metastasectomy	• FOLFOX or CAPEOX • Capecitabine or 5-FU/LV

Results of primary treatment should be assessed with CT with contrast. Scans of your chest, abdomen, and pelvis are needed. Imaging should be done prior to adjuvant treatment.

Chemotherapy follows surgery in Option 1. FOLFOX and CAPEOX are preferred regimens. Otherwise, you may receive capecitabine or 5-FU/LV. Six months of chemotherapy is preferred.

Option 2

Option 2 starts with chemotherapy. FOLFOX or CAPEOX are preferred but FOLFIRI may be received. There are pros and cons to starting with chemotherapy. Some of these are:

Pros

- You may receive early treatment of possible cancer not yet found.
- Knowing your response to chemotherapy early can help with treatment planning.
- If the cancer grows while taking chemotherapy, you can avoid local treatment.

Cons

- Fat may build up in your liver and your liver may swell.
- You may become unable to have surgery if the cancer grows or shrinks too much.
- Injury to small blood vessels may occur in your liver.

After 2 to 3 months of chemotherapy, you can get the colectomy and metastasectomy. They can be done together during one operation or apart in two operations.

Results of primary treatment should be assessed with CT with contrast. Scans of your chest, abdomen, and pelvis are needed. Imaging should be done prior to adjuvant treatment.

Sometimes, more chemotherapy will be given after surgery. FOLFOX and CAPEOX are preferred regimens. Otherwise, you may receive capecitabine or 5-FU/LV. Together, chemotherapy given before and after surgery should not exceed 6 months.

Option 3

Option 3 starts with a colectomy. Afterward, chemotherapy is received for 2 to 3 months. FOLFOX or CAPEOX are preferred but FOLFIRI may be received.

After chemotherapy, the surgery for metastases will be done. Results of primary treatment should be assessed with CT with contrast. Scans of your chest, abdomen, and pelvis are needed. Imaging should be done prior to adjuvant treatment.

Sometimes, more chemotherapy is given after surgery. FOLFOX and CAPEOX are preferred regimens. Otherwise, you may receive capecitabine or 5-FU/LV. Together, chemotherapy given before and after surgery should not exceed 6 months.

HAI ± 5-FU/LV

Instead of systemic chemotherapy, HAI may be an option. Systemic 5-FU/LV may be added. NCCN experts advise that this option should only be received at treatment centers with much experience in this method. More research is needed to learn how well this treatment works.

Guide 12 lists nonsurgical options for liver or lung metastases present at diagnosis. Chemotherapy with or without bevacizumab is advised. Panitumumab or cetuximab should only be used for left-sided tumors that have normal *KRAS* and *NRAS* genes. However, these drugs won't likely work if the tumor has a *BRAF V600E* mutation. Surgery before chemotherapy may be done only to relieve symptoms.

After chemotherapy

For some people, chemotherapy may greatly shrink the tumors. If they shrink enough, surgery to cure the cancer may be an option. Most people with metastatic colon cancer won't be able to have surgery. If surgery is possible, tests to assess the tumor size are advised every two months during chemotherapy.

Bevacizumab should be stopped 6 weeks before surgery. It increases your chance for a stroke, bleeding, and other arterial events. These events are even more likely if you are older than 65 years. Bevacizumab can be re-started 6 to 8 weeks after surgery. Otherwise, it can slow healing.

After surgery, more chemotherapy is advised. Chemotherapy received before and after surgery should not exceed 6 months. Targeted therapy may be added but more research is needed. Read Part 6 for options.

Talk to your doctor about other options after surgery. You may be able to start follow-up care. Another option may be a short course of chemotherapy.

Guide 12. Nonsurgical treatment

What are the options?
• FOLFIRI ± bevacizumab
• FOLFOX ± bevacizumab
• CAPEOX ± bevacizumab
• FOLFOXIRI ± bevacizumab
• For left-sided tumors with normal *KRAS/NRAS* genes: ◦ FOLFIRI + panitumumab ◦ FOLFIRI + cetuximab ◦ FOLFOX + panitumumab

Guide 13 lists important follow-up care for stage IV cancer. Follow-up care starts when there are no signs of cancer after treatment. It is also called survivorship care. This care should address your whole health and well-being.

Your cancer doctor and primary doctor should work together to help you. Each doctor can have a role in survivorship. Talk with your doctors about the care you want and need so you get the best plan.

Cancer tests

A medical history and physical exam are advised. Get this care every 3 to 6 months for 2 years. If results are normal for 2 years, repeat care every 6 months for another 3 years.

CEA blood tests are mainly used to detect the return of cancer. CEA levels should be tested every 3 to 6 months for 2 years. If results are normal for 2 years, get tested every 6 months for another 3 to 5 years

CT scans may help find metastases. Thus, scans of your chest, abdomen, and pelvis are advised. Get these scans every 3 to 6 months for 2 years. If results are normal for 2 years, then get these scans every 6 to 12 months for another 3 years.

CT should be done with both IV and oral contrast. CT images may be unclear or not possible. In this case, MRI of the abdomen and pelvis with non-contrast CT of the chest is an option.

Guide 13. Follow-up care

Type of care	How often is this care needed?
Medical history and physical exam	• Every 3–6 months for 2 years ◦ If normal, then repeat every 6 months for 3 years
CEA blood test	• Every 3–6 months for 2 years ◦ If normal, then repeat every 6 months for 3 years
CT of chest, abdomen, pelvis	• Every 3–6 months for 2 years
Colonoscopy	• If no prior total colonoscopy, 3–6 months after treatment • If prior total colonoscopy, 1 year after treatment ◦ If no advanced adenoma, repeat in 3 years ▪ If results are normal, then repeat every 5 years ◦ If advanced adenoma, repeat in 1 year
Side effect care	• As needed
Prevent and screen for other diseases	• Follow guidelines
Help for healthy lifestyle	• As needed

Ongoing colonoscopies are also part of follow-up care. You may never have had a total colonoscopy if your gut was blocked. If so, get a colonoscopy within 3 to 6 months after treatment. If you had a total colonoscopy before, get tested 1 year after treatment.

You'll need a colonoscopy less often if results are normal. The next test is advised in 3 years. If these results are normal, get tested every 5 years.

If an advanced adenoma is found, another colonoscopy within 1 year is advised. Advanced adenomas include polyps with a ruffled structure (villous), a polyp larger than the width of an AAA battery (>1 cm), or a polyp with pre-cancerous cells (high-grade dysplasia).

Side effect care

You may still have some side effects when follow-up care is started. Ask your cancer doctor how long they may last. Some side effects may appear months or years after treatment has ended. Ask your doctor what's your chance that you'll get these late side effects.

There may be ways to help relieve side effects. There are medicines and other methods to decrease diarrhea. A medicine called duloxetine may help painful neuropathy. Fatigue may be helped with exercise or methods to conserve energy. Ask your doctor about other ways to treat side effects.

Other care

It's important to take care of other health issues besides colon cancer. Take steps to prevent or detect other diseases early. Such steps can include getting immunizations like the flu shot.

Cancer screening is also important. Get a skin cancer exam. Ladies—learn how to do a breast self-exam. A mammogram may also be needed. Men—it may be time to get screened for prostate cancer.

Start or keep a healthy lifestyle. Limit your alcohol use. Quit smoking. Protect yourself from the sun. Be at a healthy weight. Eat healthfully. Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids.

Many people benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Metastases at recurrence

This section explains treatment options for colon cancer that returns in the liver or lungs. Options for colon cancer that can be treated with surgery are explained first. However, most people with metastases can't have surgery. If you can't have surgery, treatment options are explained on page 54.

Guide 14 presents surgical options for liver or lung metastases at recurrence. Surgery is only an option if 1) all tumors can be fully removed and 2) your liver won't be too small after surgery.

To enlarge your liver, you may receive portal vein embolization. Portal vein embolization is the blocking of the blood vessel to the liver tumor. This blockage causes the healthy part of the liver to grow larger. This procedure will be done before surgery.

Surgery with chemotherapy is advised for metastases. The best order of chemotherapy and surgery is unknown. Thus, two options are given.

Option 1

Option 1 starts primary treatment. It may consist of metastasectomy. Local therapy to the liver or lung may be added. Local therapy includes ablation and SBRT. Local therapy without surgery is also an

option. However, NCCN experts prefer surgery over local therapy.

Results of primary treatment should be assessed with CT with contrast. Scans of your chest, abdomen, and pelvis are needed. Imaging should be done prior to adjuvant treatment.

Adjuvant treatment is based on whether you had chemotherapy before. If not, preferred options are FOLFOX and CAPEOX. Otherwise, you may receive capecitabine or 5-FU/LV. Six months of chemotherapy is preferred.

If you've had chemotherapy, observation is an option. Observation is a period of testing to assess for cancer growth. Another option is chemotherapy. Targeted therapy may be added but more research is needed. Regimens are listed in Part 6. Six months of chemotherapy is preferred.

Option 2

Option 2 starts with neoadjuvant chemotherapy. FOLFOX and CAPEOX are preferred regimens. Otherwise, you may receive capecitabine or 5-FU/LV.

After 2 to 3 months of chemotherapy, you may receive primary treatment. It may consist of metastasectomy. Local therapy to the liver or lung may be added. Local therapy includes ablation and SBRT. Local therapy without surgery is

Guide 14. Surgical options

Option 1

Primary treatment	Adjuvant treatment
• Metastasectomy ± local treatment • Local treatment	• No prior chemotherapy ◦ FOLFOX or CAPEOX ◦ Capecitabine or 5-FU/LV
	• Prior chemotherapy ◦ Observation ◦ Chemotherapy ± targeted therapy in Part 6

Option 2

Neoadjuvant treatment	Primary treatment	Adjuvant treatment
• FOLFOX or CAPEOX • Capecitabine or 5-FU/LV	• Metastasectomy ± local treatment • Local treatment	• If neoadjuvant worked: ◦ Re-start neoadjuvant regimen ◦ FOLFOX ◦ Observation
		• If neoadjuvant didn't work: ◦ Chemotherapy ± targeted therapy in Part 6 ◦ Observation

another option. However, NCCN experts prefer surgery over local therapy.

Results of primary treatment should be assessed with CT with contrast. Scans of your chest, abdomen, and pelvis are needed. Imaging should be done prior to adjuvant treatment.

Adjuvant treatment is based on the success of neoadjuvant treatment. If neoadjuvant chemotherapy worked, you may re-start that treatment or take FOLFOX. Together, chemotherapy given before and after surgery should not exceed 6 months. A third option is observation.

If neoadjuvant treatment didn't work, you may have two options. One option is chemotherapy. Targeted therapy may be added but more research is needed. Regimens are listed in Part 6. Six months of chemotherapy is preferred. The second option is observation.

HAI ± 5-FU/LV

Instead of systemic chemotherapy, HAI may be an option. Systemic 5-FU/LV may be added. NCCN experts advise that this option should only be received at treatment centers with much experience in this method. More research is needed to learn how well this treatment works.

Guide 15 lists nonsurgical options for liver or lung metastases present at recurrence. Options are based on your history of chemotherapy. Options for people who had FOLFOX or CAPEOX in the past 12 months are explained below. Options for everyone else are listed in Part 6.

FOLFOX or CAPEOX ≥12 months

Two options are FOLFIRI and irinotecan. Targeted therapy may be added. Bevacizumab is preferred but other options are ziv-aflibercept or ramucirumab. If the tumor has normal *KRAS/NRAS* genes, other options are to add panitumumab or cetuximab to chemotherapy. However, these drugs won't likely work if the tumor has a *BRAF V600E* mutation.

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option.

After chemotherapy

For some people, chemotherapy may greatly shrink the tumors. If they shrink enough, surgery to cure the cancer may be an option. Most people with metastatic colon cancer won't be able to have surgery. If surgery is possible, tests to assess the tumor size are advised every two months during chemotherapy.

Bevacizumab should be stopped 6 weeks before surgery. It increases your chance for a stroke, bleeding, and other arterial events. These events are even more likely if you are older than 65 years. Bevacizumab can be re-started 6 to 8 weeks after surgery. Otherwise, it can slow healing.

After surgery, more chemotherapy is advised. Chemotherapy received before and after surgery should not exceed 6 months. Targeted therapy may be added but more research is needed. Read Part 6 for options.

Guide 15. Nonsurgical options

Chemotherapy history	What are the options?
Adjuvant FOLFOX or CAPEOX ≤12 months ago	• FOLFIRI • FOLFIRI + bevacizumab • FOLFIRI + ziv-aflibercept • FOLFIRI + ramucirumab • Irinotecan • Irinotecan + bevacizumab • Irinotecan + ziv-aflibercept • Irinotecan + ramucirumab • If normal *KRAS/NRAS* gene: ◦ FOLFIRI + panitumumab ◦ FOLFIRI + cetuximab • If dMMR or MSI-H: ◦ Nivolumab ◦ Pembrolizumab
Adjuvant FOLFOX or CAPEOX >12 months ago	• Treatments listed in Part 6
Prior 5-FU/LV or capecitabine	• Treatments listed in Part 6
Never had chemotherapy	• Treatments listed in Part 6

Talk to your doctor about other options after surgery. You may be able to start follow-up care. Another option may be a short course of chemotherapy.

Review

- Cancer in distant sites is called a metastasis. Colon cancer most often spreads to the liver and sometimes the lungs.
- Metastases may be present when you first learn that you have colon cancer. Metastases may also occur if the cancer re-appears during follow-up care.
- Some colon cancers with metastases can be treated with surgery. Local therapy may be used along with surgery or be used by itself. Chemotherapy should also be part of treatment.
- Most colon cancers with metastases cannot be treated with surgery. In most cases, chemotherapy is advised. Targeted therapy may be added.

6
Chemotherapy

Part 6 presents the chemotherapy pathways used to treat advanced colon cancer. There are many options. If one option doesn't work or stops working, another option is given.

Oxaliplatin

Guide 16 maps a treatment path that starts with oxaliplatin. After oxaliplatin, there are other options for second-line treatment and beyond. Some of these options depend on what treatment you've had before.

First-line options

FOLFOX and CAPEOX are the two options for first-line treatment. Bevacizumab may be added to either regimen. Cetuximab or panitumumab can be added to FOLFOX to treat tumors with normal *RAS* genes that are in the left side of the colon. However, neither is likely to work if a *BRAF V600E* mutation is present.

Oxaliplatin can harm your nervous system. Stopping oxaliplatin—but not the other drugs—after 3 months of use may prevent harm. Keep taking the other drugs for 6 months. If the cancer progresses, oxaliplatin may be restarted if it was stopped due to side effects. You should only restart if the side effects have ended.

Capecitabine in the CapeOx regimen can cause a side effect known as hand-foot syndrome. Symptoms include redness, swelling, and pain on the palms of the hands, bottoms of feet, or both. Sometimes blisters appear. Your dose of capecitabine may be changed at the earliest signs of hand-foot syndrome.

Second-line options

Oxaliplatin may not prevent the cancer from progressing. If this happens, you may start FOLFIRI or irinotecan. Bevacizumab, ziv-aflibercept, or ramucirumab may be added. Bevacizumab is preferred due to less harsh side effects and lower costs.

Cetuximab or panitumumab may be options for tumors with normal *RAS* genes. Tumors can be in any part of the colon. You must not have received either drug before. Cetuximab or panitumumab may be added to FOLFIRI or irinotecan. Either drug can be used alone if you can't take irinotecan.

Guide 16. Oxaliplatin pathway

What are first-line options?
• FOLFOX ± ◦ Bevacizumab ◦ Cetuximab or panitumumab for left-side tumors with normal *KRAS/NRAS* genes
• CAPEOX ± bevacizumab
What are second-line options?
• FOLFIRI or irinotecan ± ◦ Bevacizumab or ziv-aflibercept or ramucirumab ◦ Cetuximab or panitumumab 1) for tumors with normal *KRAS/NRAS* genes and 2) if neither drug was received before
• Cetuximab or panitumumab 1) for tumors with normal *KRAS/NRAS* genes and 2) if neither drug was received before
• Pembrolizumab or nivolumab if dMMR or MSI-H
What are third-line and beyond options?
• Some second-line regimens if not received before
• Regorafenib
• Trifluridine + tipiracil
• Clinical trial
• Best supportive care

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option. If these drugs don't work, your next options include other second-line options listed above.

Third-line and beyond

If the cancer progresses again, one of the 3 second-line treatments may be an option. If not, your options may include regorafenib or trifluridine with tipiracil. There may also be a clinical trial that you could join. Supportive care may give you relief from symptoms.

Irinotecan

Guide 17 maps a treatment path that starts with FOLFIRI. After FOLFIRI, there are other options for second-line treatment and beyond. Some of these options depend on what treatment you've had before.

First-line options

Irinotecan is part of the FOLFIRI regimen. It should be used with caution and at a low dose if you have Gilbert's disease. Gilbert's disease is a health problem that people are born with. The disease impairs the liver from correctly processing bilirubin. Irinotecan should be used with caution and at a low dose if you have high bilirubin levels in your blood for any reason.

Targeted therapy may be added to FOLFIRI. Bevacizumab may help treat colon cancer. Cetuximab or panitumumab may help treat tumors with normal *RAS* genes that are in the left side of the colon. However, neither are likely to work if a *BRAF V600E* mutation is present.

Second-line options

FOLFIRI may not prevent the cancer from progressing. If this happens, you may start to take an oxaliplatin regimen—FOLFOX or CAPEOX. Bevacizumab may be added.

Cetuximab or panitumumab may be options for tumors with normal *RAS* genes. Tumors can be in any part of the colon. You must not have received either drug before. Cetuximab or panitumumab may be received with irinotecan. If you're unable to take

Guide 17. Irinotecan pathway

What are first-line options?
• FOLFIRI ± ◦ Bevacizumab ◦ Cetuximab or panitumumab for left-side tumors with normal *KRAS/NRAS* genes
What are second-line options?
• FOLFOX or CAPEOX ± bevacizumab
• Irinotecan + cetuximab or panitumumab 1) for tumors with normal *KRAS/NRAS* genes and 2) if neither drug was received before
• Cetuximab or panitumumab 1) for tumors with normal *KRAS/NRAS* genes and 2) if neither drug was received before
• Pembrolizumab or nivolumab if dMMR or MSI-H
What are third-line and beyond options?
• Some second-line regimens if not received before
• Regorafenib
• Trifluridine + tipiracil
• Clinical trial
• Best supportive care

irinotecan, you may take panitumumab or cetuximab alone.

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option. If these drugs don't work, your next options include other second-line options listed above.

Third-line and beyond

If the cancer progresses again, one of the 4 second-line treatments may be an option. If not, your options may include regorafenib or trifluridine with tipiracil. There may also be a clinical trial that you could join. Supportive care may give you relief from symptoms.

FOLFOXIRI

Guide 18 maps a treatment path that starts with FOLFOXIRI. After FOLFOXIRI, there are other options for second-line treatment and beyond. Some of these options depend on what treatment you've had before.

First-line options

The FOLFOXIRI pathway starts with both oxaliplatin and irinotecan. It is an intense regimen and is not for everybody. Bevacizumab may be added.

Second-line options

FOLFOXIRI may not prevent the cancer from progressing. In this happens, there are 5 second-line options. Some options do not apply to everyone.

Cetuximab or panitumumab may be options for tumors with normal *RAS* genes. However, neither are likely to work if a *BRAF V600E* mutation is present. Tumors can be in any part of the colon. Cetuximab or panitumumab may be received with irinotecan. If you're unable to take irinotecan, you may take panitumumab or cetuximab alone.

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option. If these drugs don't work, your next options include other second-line options.

There are two other options if the cancer has progressed on all other regimens. One option is to receive regorafenib. The other option is trifluridine with tipiracil.

Third-line and beyond

If the cancer progresses again, one of the second-line treatments may be an option. If not, there may be a clinical trial that you could join. Supportive care may give you relief from symptoms.

Guide 18. FOLFOXIRI pathway

What are first-line options?
• FOLFOXIRI ± bevacizumab
What are second-line options?
• Irinotecan + cetuximab or panitumumab for tumors with normal *KRAS/NRAS* genes
• Cetuximab or panitumumab for tumors with normal *KRAS/NRAS* genes
• Pembrolizumab or nivolumab if dMMR or MSI-H
• Regorafenib
• Trifluridine + tipiracil
What are third-line and beyond options?
• Some second-line regimens if not received before
• Clinical trial
• Best supportive care

5-FU and capecitabine

Guide 19 maps a treatment path that starts with intense but less harsh regimens. After either regimen, there are other options for second-line treatment and beyond. Some of these options depend on what treatment you've had before.

First-line options

There are two options for first-line treatment. One option is 5-FU/LV. Receiving 5-FU by infusion is preferred over bolus injection. The second option is capecitabine. Bevacizumab may be added to either option.

The side effects of these regimens aren't usually as bad as those caused by oxaliplatin or irinotecan. Thus, if the cancer progresses, you should start supportive care if the side effects were too harsh. If not too harsh, second-line options may be of help.

Second-line options

If the cancer progresses, options include regimens with oxaliplatin, irinotecan, or both. Targeted therapy may be added. Bevacizumab is preferred over ziv-aflibercept and ramucirumab.

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option. If these drugs don't work, your next options include other second-line options listed above.

Third-line and beyond

If the cancer progresses again, there are multiple options. Some of the second-line treatments may be an option if not received before.

Cetuximab or panitumumab may be options for tumors with normal *RAS* genes. Tumors can be in any part of the colon. You must not have received either drug before. Irinotecan with cetuximab or panitumumab may be an option. Cetuximab or panitumumab can be used alone if you can't take irinotecan.

There are two other options if the cancer has progressed on all other regimens. One option is to receive regorafenib. The other option is trifluridine with tipiracil.

Joining a clinical trial may be an option. Ask your doctor if there is a trial that is right for you. If there are no other options, supportive care may give you relief from symptoms.

Guide 19. 5-FU and capecitabine pathway

What are first-line options?
• 5-FU/LV ± bevacizumab
• Capecitabine ± bevacizumab
What are second-line options?
• FOLFOX or CAPEOX ± bevacizumab
• FOLFIRI or irinotecan ± bevacizumab or ziv-aflibercept or ramucirumab
• Irinotecan + oxaliplatin ± bevacizumab
• Pembrolizumab or nivolumab if dMMR or MSI-H
What are third-line and beyond options?
• Some second-line regimens if not received before
• Irinotecan + cetuximab or panitumumab for tumors with normal *KRAS/NRAS* genes
• Cetuximab or panitumumab for tumors with normal *KRAS/NRAS* genes
• Regorafenib
• Trifluridine + tipiracil
• Clinical trial
• Best supportive care

Least toxic regimens

Guide 20 lists regimens that are likely to be the least harmful to you. Infusional 5-FU/LV is an option. 5-FU has fewer severe side effects when given by infusion rather than bolus. Another option is to take capecitabine with or without bevacizumab.

Cetuximab or panitumumab may be an option. These drugs treat tumors with normal *RAS* genes that are in the left side of the colon. Neither drug is likely to work if a *BRAF V600E* mutation is present.

The cancer cells may have a dMMR system or MSI-H. The MMR system is explained in Part 2. In this case, nivolumab or pembrolizumab may be an option. If these drugs don't work, your next options include other second-line options listed above.

If treatment works, you may find that you are able to do more activities. In this case, the regimens listed in the prior sections may be options. Otherwise, supportive care may give you relief from symptoms.

Guide 20. Least toxic pathway

What are first-line options?
• Infusional 5-FU/LV ± bevacizumab
• Capecitabine ± bevacizumab
• Cetuximab or panitumumab for left-sided tumors with normal *KRAS/NRAS* genes
• Pembrolizumab or nivolumab if dMMR or MSI-H
What are second-line options?
• More intense chemotherapy
• Supportive care

Review

- There are five pathways used to treat advanced colon cancer.
- The oxaliplatin pathway starts with either FOLFOX or CAPEOX.
- The irinotecan pathway starts with FOLFIRI.
- The FOLFOXIRI pathway starts with both oxaliplatin and irinotecan.
- The 5-FU/LV and capecitabine pathway starts with intense but less harsh regimens.
- The least toxic pathway starts with regimens likely to be the least harmful to you.

7
Making treatment decisions

Having cancer is very stressful. While absorbing the fact that you have cancer, you have to learn about tests and treatments. In addition, the time you have to accept a treatment plan feels short. Parts 1 through 6 described the cancer and treatment options. Part 7 aims to help you make decisions that are in line with your beliefs, wishes, and values.

It's your choice

The role each person wants in choosing his or her treatment differs. You may feel uneasy about making treatment decisions. This may be due to a high level of stress. It may be hard to hear or know what others are saying. Stress, pain, and drugs can limit your ability to make good decisions. You may feel uneasy because you don't know much about cancer. You've never heard the words used to describe cancer, tests, or treatments. Likewise, you may think that your judgment isn't any better than your doctors'.

Letting others decide which option is best may make you feel more at ease. But, whom do you want to make the decisions? You may rely on your doctors alone to make the right decisions. However, your doctors may not tell you which option to choose if you have multiple good options. You can also have loved ones help. They can gather information, speak on your behalf, and share in decision-making with your doctors. Even if others decide which treatment you will receive, you still have to agree by signing a consent form.

On the other hand, you may want to take the lead or share in decision-making. Most patients do. In shared decision-making, you and your doctors share information, weigh the options, and agree on a treatment plan. Your doctors know the science behind your plan but you know your concerns and goals. By working together, you are likely to get a higher quality of care and be more satisfied. You'll likely get the treatment you want, at the place you want, and by the doctors you want.

Questions to ask your doctors

You may meet with experts from different fields of medicine. Strive to have helpful talks with each person. Prepare questions before your visit and ask questions if the person isn't clear. You can also take notes and get copies of your medical records.

It may be helpful to have your spouse, partner, family member, or a friend with you at these visits. A patient advocate or navigator might also be able to come. They can help to ask questions and remember what was said. Suggested questions to ask are listed on the following pages.

What's my diagnosis and prognosis?

It's important to know that there are different types of cancer. Cancer can greatly differ even when people have a tumor in the same organ. Based on your test results, your doctors can tell you which type of cancer you have. He or she can also give a prognosis. A prognosis is a prediction of the pattern and outcome of a disease. Knowing the prognosis may affect what you decide about treatment.

1. Where did the cancer start? In what type of cell? Is this cancer common?
2. What is the cancer stage? Does this stage mean the cancer has spread far?
3. Is this a fast- or slow-growing cancer?
4. What tests do you recommend for me?
5. Where will the tests take place? How long will the tests take and will any test hurt?
6. What if I am pregnant?
7. How do I prepare for testing?
8. Should I bring a list of my medications?
9. Should I bring someone with me?
10. How often are these tests wrong?
11. Would you give me a copy of the pathology report and other test results?
12. Who will talk with me about the next steps? When?

What are my options?

There is no single treatment practice that is best for all people. There is often more than one treatment option along with clinical trial options. Your doctor will review your test results and recommend treatment options.

1. What will happen if I do nothing?
2. Can I just carefully monitor the cancer?
3. Do you consult NCCN recommendations when considering options?
4. Are you suggesting options other than what NCCN recommends? If yes, why?
5. Do your suggested options include clinical trials? Please explain why.
6. How do my age, health, and other factors affect my options? What if I am pregnant?
7. Which option is proven to work best?
8. Which options lack scientific proof?
9. What are the benefits of each option? Does any option offer a cure or long-term cancer control? Are my chances any better for one option than another? Less time-consuming? Less expensive?
10. What are the risks of each option? What are possible complications? What are the rare and common side effects? Short-lived and long-lasting side effects? Serious or mild side effects? Other risks?
11. How do you know if treatment is working?
12. What are my options if my treatment stops working?
13. What can be done to prevent or relieve the side effects of treatment?

What does each option require of me?

Many patients consider how each option will practically affect their lives. This information may be important because you have family, jobs, and other duties to take care of. You also may be concerned about getting the help you need. If you have more than one option, choosing the option that is the least taxing may be important to you:

1. Will I have to go to the hospital or elsewhere? How often? How long is each visit?
2. What do I need to think about if I will travel for treatment?
3. Do I have a choice of when to begin treatment? Can I choose the days and times of treatment?
4. How do I prepare for treatment? Do I have to stop taking any of my medicines? Are there foods I will have to avoid?
5. Should I bring someone with me when I get treated?
6. Will the treatment hurt?
7. How much will the treatment cost me? What does my insurance cover?
8. Will I miss work or school? Will I be able to drive?
9. Is home care after treatment needed? If yes, what type?
10. How soon will I be able to manage my own health?
11. When will I be able to return to my normal activities?

What is your experience?

More and more research is finding that patients treated by more experienced doctors have better results. It is important to learn if a doctor is an expert in the cancer treatment he or she is offering.

1. Are you board certified? If yes, in what area?
2. How many patients like me have you treated?
3. How many procedures like the one you're suggesting have you done?
4. Is this treatment a major part of your practice?
5. How many of your patients have had complications?

Deciding between options

Deciding which option is best can be hard. Doctors from different fields of medicine may have different opinions on which option is best for you. This can be very confusing. Your spouse or partner may disagree with which option you want. This can be stressful. In some cases, one option hasn't been shown to work better than another. Some ways to decide on treatment are discussed next.

2nd opinion

The time around deciding a treatment is very stressful. People with cancer often want to get treated as soon as possible. They want to make their cancer go away before it spreads farther. While cancer can't be ignored, usually there is time to think about and choose which option is best for you.

You may wish to have another doctor review your test results and suggest a treatment plan. This is called getting a 2nd opinion. You may completely trust your doctor, but a 2nd opinion about which option is best can help.

Copies of the pathology report, a DVD of the imaging tests, and other test results need to be sent to the doctor giving the 2nd opinion. Some people feel uneasy asking for copies from their doctors. However, a 2nd opinion is a normal part of cancer care.

When doctors have cancer, most will talk with more than one doctor before choosing their treatment. What's more, some health plans require a 2nd opinion. If your health plan doesn't cover the cost of a 2nd opinion, you have the choice of paying for it yourself.

If the two opinions are the same, you may feel more at peace about the treatment you accept to have. If the two opinions differ, think about getting a 3rd opinion. A 3rd opinion may help you decide between your options. Choosing your cancer treatment is a very important decision. It can affect your length and quality of life.

Support groups

Besides talking to health experts, it may help to talk to other people who have walked in your shoes. At support groups, you can ask questions and hear about the experiences of other people with colon cancer. Find a support group at the websites listed on page 69.

Compare benefits and downsides

Every option has benefits and downsides. Consider these when deciding which option is best for you. Talking to others can help identify benefits and downsides you haven't thought of. Scoring each factor from 0 to 10 can also help since some factors may be more important to you than others.

Websites

American Cancer Society
cancer.org/cancer/colonandrectumcancer/detailedguide/index

Cancer Support Community
cancersupportcommunity.org

Colon Cancer Alliance
ccalliance.org

Fight Colorectal Cancer
FightColorectalCancer.org

National Cancer Institute (NCI)
cancer.gov/types/colorectal

National Coalition for Cancer Survivorship
canceradvocacy.org/toolbox

NCCN for Patients®
nccn.org/patients

Review

- Shared decision-making is a process in which you and your doctors plan treatment together.
- Asking your doctors questions is vital to getting the information you need to make informed decisions.
- Getting a 2nd opinion, attending support groups, and comparing benefits and downsides may help you decide which treatment is best for you.

Glossary

Dictionary

abdomen
The belly area between the chest and pelvis.

ablation
Treatment using radiofrequency or cold to destroy cancer cells.

adenocarcinoma
Cancer in cells that line organs and make fluids or hormones.

adenoma
The most common type of polyp and is the most likely to form cancer cells. Also called adenomatous polyps.

adjuvant treatment
Treatment that is given to lower the chances of the cancer returning.

adventitia
The outer layer, in some places, of the colon wall.

angiolymphatic invasion
Cancer has spread into the tumor's lymph or blood vessels.

anus
The opening at the end of the digestive system that allows stool to pass out of the body.

bilirubin
A substance in the body that causes bodily fluids to be yellow.

biopsy
Removal of small amounts of tissue or fluid to be tested for disease.

bolus
A fast injection of a drug.

boost
An extra dose of radiation to a specific area of the body.

brachytherapy
Treatment with radiation received from an object placed near or in the tumor.

cancer grade
How closely the cancer cells look like normal cells.

cancer stage
Rating of the growth and spread of tumors.

carcinoembryonic antigen (CEA)
A protein that gets released by some tumors and can be detected in blood as a tumor marker.

carcinoma in situ
Cancer that has not grown into tissue that could allow cancer cells to spread. It is a noninvasive cancer.

catheter
A flexible tube inserted in the body to give treatment or drain fluid from the body.

chemotherapy
Drugs that stop the life cycle of cells so they don't increase in number.

clinical stage
The rating of the extent of cancer based on tests before treatment.

clinical trial
Research on a test or treatment to assess its safety or how well it works.

colectomy
Surgery to remove a part of the colon.

colonoscope
A thin, long tube with a light and camera used to see the colon.

colonoscopy
Insertion of a thin tool into the colon to view or remove tissue.

colostomy
Surgery to connect a part of the colon to the outside of the abdomen and allows stool to drain into a bag.

complete blood count (CBC)
A test of the number of blood cells.

computed tomography (CT)
A test that uses x-rays from many angles to make a picture of the inside of the body.

contrast
A dye put into your body to make clearer pictures during imaging tests.

defective mismatch repair (dMMR)
Abnormal changes in genes that contain instructions for making proteins that fix errors in DNA.

deoxyribonucleic acid (DNA)
A very thin and long molecule that contains genetic code. Also called the “blueprint of life.”

diagnosis
To identify a disease.

digestive system
A set of organs in the body that changes food into small parts for the body to use as energy.

embolization
Blockage of blood flow to a tumor with beads that emit either chemotherapy or radiation.

endoscopic polypectomy
Surgery to remove a polyp during a colonoscopy.

enema
Injection of liquid into the rectum to clear the bowel.

epidermal growth factor receptor (EGFR)
A protein on the edge of a cell that sends signals for the cell to grow.

epithelium
Tissue that lines the colon wall.

esophagus
The tube-shaped digestive organ between the mouth and stomach.

external beam radiation therapy (EBRT)
Treatment with radiation received from a machine outside the body.

familial adenomatous polyposis (FAP)
An inherited medical condition that increases the odds of colon cancer.

gene
Coded instructions in cells for making new cells and controlling how cells behave.

general anesthesia
A controlled loss of wakefulness from drugs.

hereditary non-polyposis colon cancer (HNPCC)
An inherited medical condition that increases the odds of colon cancer. Also called Lynch syndrome.

histologic typing
The study of cells to classify disease.

hives
Itchy, swollen, and red skin caused by the body ridding itself of an invader.

hyperplastic polyp
A polyp that grows fast and is often found in the last part of the colon.

imaging test
A test that makes pictures of the insides of the body.

immunohistochemistry (IHC)
A lab test of cancer cells to find specific cell traits involved in abnormal cell growth.

inflammatory bowel disease
A medical condition that causes the intestine to swell.

inflammatory polyp
A polyp that often grows after the intestine swells.

infusion
A method of giving drugs slowly through a needle into a vein.

intensity-modulated radiation therapy (IMRT)
Radiation therapy that uses small beams of different strengths based on the thickness of the tissue.

intraoperative radiation therapy (IORT)
Radiation therapy that is given inside the body at the end of an operation.

invasive cancer
Cancer cells have grown into the second layer of the colon wall.

lamina propria
Connective tissue within the mucosa of the colon wall.

large intestine
The digestive organ that prepares unused food for leaving the body.

laxative
Drugs used to clean out the intestines.

lymph
A clear fluid containing white blood cells.

lymph node
Small groups of special disease-fighting cells located throughout the body.

lymphadenectomy
Surgery to remove lymph nodes.

magnetic resonance imaging (MRI)
A test that uses a magnetic field and radio waves to make pictures of the insides of the body.

medical history
All health events and medications taken to date.

metastasectomy
Surgery to remove cancer that has spread far from the first tumor.

metastasis
The spread of cancer cells from the first (primary) tumor to a distant site.

microsatellite instability (MSI)
Errors in a small DNA part that happen when DNA is making a copy of itself.

microsatellite instability-high (MSI-H)
The presence of 2 or more MSI markers.

mismatch repair (MMR) proteins
Proteins that correct DNA errors that occur when copies of DNA are being made.

mucosa
The first, inner layer of the colon wall.

mucus
A sticky, thick liquid that moisturizes or lubricates.

muscularis mucosae
A thin layer of muscle within the mucosa of the colon wall.

muscularis propria
The third layer of the colon wall made mostly of muscle.

mutation
An abnormal change in the instructions within cells for making and controlling cells.

needle biopsy
Removal of tissue or fluid samples from the body with a needle.

neoadjuvant treatment
Treatment given before the main treatment used to cure disease. Also called preoperative treatment.

noninvasive cancer
Cancer cells have not grown into the second layer of the colon wall.

observation
A period of testing for cancer growth.

parietal peritoneum
The outer layer of tissue lining around the abdomen.

pathologic stage
A rating of the extent of cancer based on tests given after treatment.

pathologist
A doctor who's an expert in testing cells and tissue to find disease.

pedunculated polyp
A polyp shaped like a mushroom with a stalk.

pelvis
The area between the hip bones.

perineural invasion
Spread of cancer into nearby nerves.

physical exam
A review of the body by a health expert for signs of disease.

polymerase chain reaction (PCR)
A process in which copies of a DNA part are made.

polyp
An extra growth of tissue from the epithelium of the colon wall.

portal vein embolization
The blood vessel to the liver tumor is blocked causing the healthy part of the liver to grow larger.

positron emission tomography (PET)
Use of radioactive material to see the shape and function of body parts.

positron emission tomography/computed tomography (PET/CT)
A test that uses radioactive material and x-rays to view the shape and function of organs and tissues.

primary tumor
The first mass of cancer cells in the body.

prognosis
The pattern and outcome of a disease.

progression
The growth or spread of cancer after being tested or treated.

radiation therapy
The use of high-energy rays to destroy cancer cells.

radiologist
A doctor who specializes in reading imaging tests.

rectum
An organ in the digestive system that holds stool until expelled from the body.

recurrence
The return of cancer after a cancer-free period.

serosa
The outer layer, in some places, of the colon wall that makes fluid so that organs can slide against one another; also called the visceral peritoneum.

sessile polyp
A polyp that is flat.

side effect
An unplanned physical or emotional response to treatment.

small intestine
The digestive organ that absorbs nutrients from eaten food.

stereotactic body radiation therapy (SBRT)
Radiation therapy that uses precise, high-dose beams.

stool
Unused food passed out of the body; also called feces.

submucosa
The second layer of the colon wall made mostly of connective tissue.

subserosa
A thin layer of connective tissue that makes fluid.

supportive care
Treatment for the symptoms or health conditions caused by cancer or cancer treatment.

surface receptor
A protein found in the membrane of cells.

surgical margin
The normal tissue around the edge of a tumor that is removed during surgery.

targeted therapy
Drugs that stop the action of molecules that start the growth of cancer cells.

three-dimensional conformal radiation therapy (3D-CRT)
Radiation therapy that uses beams that match the shape of the tumor.

total colonoscopy
Insertion of a thin tool into the colon to view the entire colon and, if needed, remove tissue.

tumor budding
A group of 5 or fewer cancer cells separate from the main tumor.

tumor deposit
The presence of tiny tumors where the lymph drains from the tumor.

ultrasound
A test that uses sound waves to take pictures of the insides of the body.

vascular endothelial growth factor (VEGF)
A molecule that binds to cells that form blood vessels.

villous polyp
A polyp with a ruffled structure.

Acronyms

3D-CRT
three-dimensional conformal radiation therapy

AJCC
American Joint Committee on Cancer

CBC
complete blood count

CEA
carcinoembryonic antigen

CT
computed tomography

dMMR
defective mismatch repair

DNA
deoxyribonucleic acid

EBRT
external beam radiation therapy

EGF
epidermal growth factor

EGFR
epidermal growth factor receptor

FAP
familial adenomatous polyposis

FDA
Food and Drug Administration

HAI
hepatic arterial infusion

HNPCC
hereditary non-polyposis colon cancer

IHC
immunohistochemistry

IMRT
intensity-modulated radiation therapy

IORT
intraoperative radiation therapy

MMR
mismatch repair

MRI
magnetic resonance imaging

MSI
microsatellite instability

MSI-H
microsatellite instability-high

MSI-L
microsatellite instability-low

MSS
microsatellite stable

NCCN®
National Comprehensive Cancer Network®

PCR
polymerase chain reaction

PET
positron emission tomography

PET/CT
positron emission tomography/ computed tomography

SBRT
stereotactic body radiation therapy

VEGF
vascular endothelial growth factor

State Fundraising Notices

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Axel Grothey, MD
Mayo Clinic Cancer Center

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Yale Cancer Center/Smilow Cancer Hospital

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Moffitt Cancer Center

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Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine

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University of Alabama at Birmingham Comprehensive Cancer Center

Natalie Kirilcuk, MD
Stanford Cancer Institute

Smitha Krishnamurthi, MD
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Huntsman Cancer Institute at the University of Utah

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Christina S. Wu, MD
The Ohio State University Comprehensive Cancer Center - James Cancer Hospital and Solove Research Institute

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For disclosures, visit www.nccn.org/about/disclosure.aspx.

NCCN Member Institutions

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Omaha, Nebraska
800.999.5465
nebraskamed.com/cancer

Case Comprehensive Cancer Center/
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Cancer Center
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massgeneral.org/cancer

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206.667.5000 • fredhutch.org

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hopkinskimmelcancercenter.org

Robert H. Lurie Comprehensive Cancer
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Chicago, Illinois
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cancer.northwestern.edu

Mayo Clinic Cancer Center
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Jacksonville, Florida
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904.953.0853 • Florida
507.538.3270 • Minnesota
mayoclinic.org/departments-centers/mayo-clinic-cancer-center

Memorial Sloan Kettering
Cancer Center
New York, New York
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mskcc.org

Moffitt Cancer Center
Tampa, Florida
800.456.3434
moffitt.org

The Ohio State University
Comprehensive Cancer Center -
James Cancer Hospital and
Solove Research Institute
Columbus, Ohio
800.293.5066
cancer.osu.edu

Roswell Park Cancer Institute
Buffalo, New York
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roswellpark.org

Siteman Cancer Center at Barnes-
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University School of Medicine
St. Louis, Missouri
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Colon Cancer

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