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Multiple Myeloma

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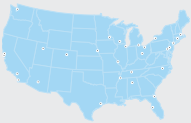
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These guidelines are based on the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Multiple Myeloma (Version 2.2019, November 16, 2018).

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BMT InfoNet provides information and support services to patients undergoing a bone marrow, stem cell or cord blood transplant service. Our mission is to empower patients and their loved ones with reliable information and support about issues before, during and after transplant so that they may take an active, informed role in managing their healthcare choices. Visit us online at www.bmtinfonet.org, or contact us by email at help@bmtinfonet.org and by phone 847-433-3313. www.bmtinfonet.org

The Leukemia & Lymphoma Society (LLS)

LLS is dedicated to developing better outcomes for blood cancer patients through research, education and patient services and is happy to have this comprehensive resource available to patients. www.LLS.org/information specialists

Multiple Myeloma Research Foundation (MMRF)

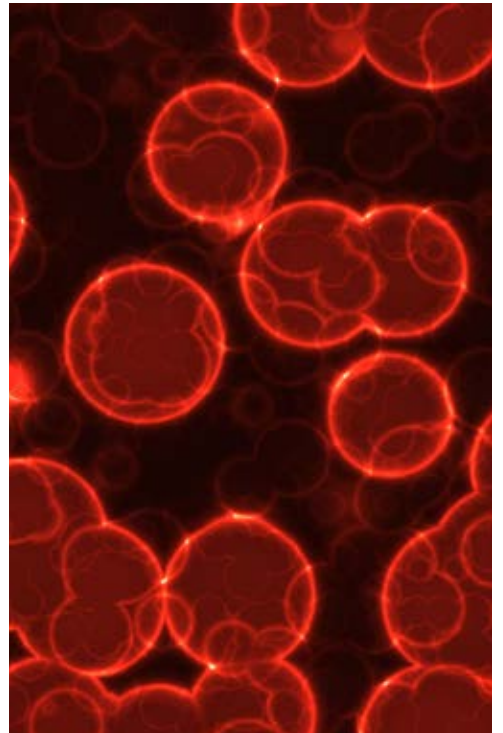
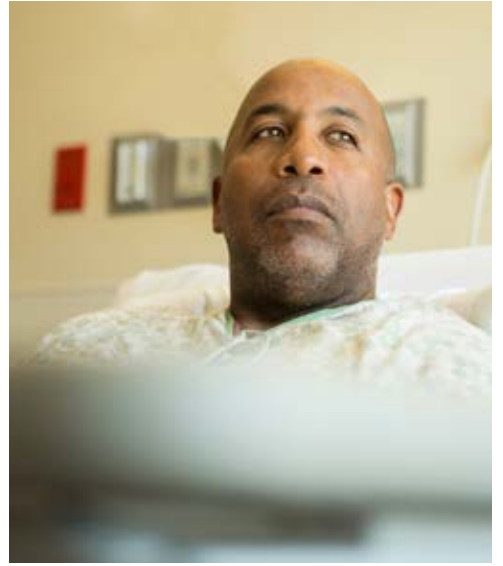
Empowering patients to make informed decisions about their diagnosis and treatment in the rapidly changing field of myeloma is critical to advancing precision medicine. The Multiple Myeloma Research Foundation is supportive of resources like the NCCN Guidelines for Patients. www.themmr.org

National Bone Marrow Transplant Link (nbmtLINK)

Educating and informing people about their cancer diagnosis as well as the transplant process is an important part of the National Bone Marrow Transplant Link's mission and contributes to the psychosocial support of bone marrow/ stem cell transplant patients and their caregivers. For information and resources, please visit nbmtlink.org, call toll free at 800-LINK-BMT or e-mail, info@nbmtlink.org. The LINK is supportive of resources like the NCCN Guidelines for Patients. www.nbmtlink.org

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Who should read this book?

This book is about treatment for multiple myeloma, a type of cancer that starts in plasma cells. Patients and those who support them—caregivers, family, and friends—may find this book helpful. It may help you discuss and decide with your doctors what care is best.

Are the book chapters in a certain order?

Early chapters explain concepts that are repeated in later chapters. Starting with **Part 1** may be helpful for many people. It explains what multiple myeloma is. Knowing more about this cancer may help you better understand its treatment.

Part 2 explains the tests doctors use to assess for this type of cancer and plan treatment. **Part 3** describes the types of treatments that may be used. **Part 4** is a guide to treatment options. **Part 5** offers some helpful tips for making treatment decisions.

Does this book include all options?

This book includes information for many situations. Ask your treatment team to point out what information applies to you. As you read through this book, you may find it helpful to make a list of questions to ask your doctors.

The recommendations in this book are based on science and the experience of NCCN experts. These recommendations may not be right for everyone. Your doctors may suggest other tests and treatments based on your health and other factors. If other suggestions are given, feel free to ask your treatment team questions.

Help! What do the words mean?

In this book, many medical words are included. These are words you will likely hear from your treatment team. Most of these words may be new to you, and it may be a lot to learn.

Don't be discouraged as you read. Keep reading and review the information. Feel free to ask your treatment team to explain a word or phrase that you don't 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*. One example is CBC for complete blood count.

1

About multiple myeloma

- 8 Plasma cells
- 10 Multiple myeloma basics
- 10 M-proteins
- 12 Symptoms of myeloma
- 13 Review



You've learned that you have or may have multiple myeloma. This chapter explains some basics about this cancer that may help you make treatment decisions.

Plasma cells

Blood is made of many types of cells, called blood cells. The three main types of blood cells are platelets, red blood cells, and white blood cells. Each type of blood cell has a certain job in the body. Platelets help control bleeding. Red blood cells carry oxygen throughout the body. White blood cells help fight germs and infections in the body. They are part of your body's disease-fighting system—called the *immune system*.

Most blood cells are made in bone marrow. Bone marrow is the soft, sponge-like tissue found in the center of most bones. **See Figure 1.** Blood cells are made from special, immature cells called *blood stem cells*. Blood stem cells can develop into all types of mature blood cells.

Many types of white blood cells are made from a blood stem cell. **See Figure 2.** Types of white blood cells include granulocytes, B cells, and T cells. The different types of white blood cells fight germs in different ways. When germs invade the body, B cells change into plasma cells. In a healthy person, less than 5 out of 100 cells in the bone marrow are plasma cells.

Plasma cells make antibodies (also called immunoglobulins). Antibodies are proteins that help your body find and kill germs. Each type of plasma cell makes only one type of antibody. The type of antibody made is meant to attack the specific germ that is causing the infection or illness. There are five types of antibodies or immunoglobulins (IgG, IgA, IgM, IgE, and IgD). Each type has a different role.

Figure 1
Blood cells in bone marrow

Bone marrow is the soft, sponge-like tissue in the center of most bones. Blood stem cells in the bone marrow make all types of blood cells.

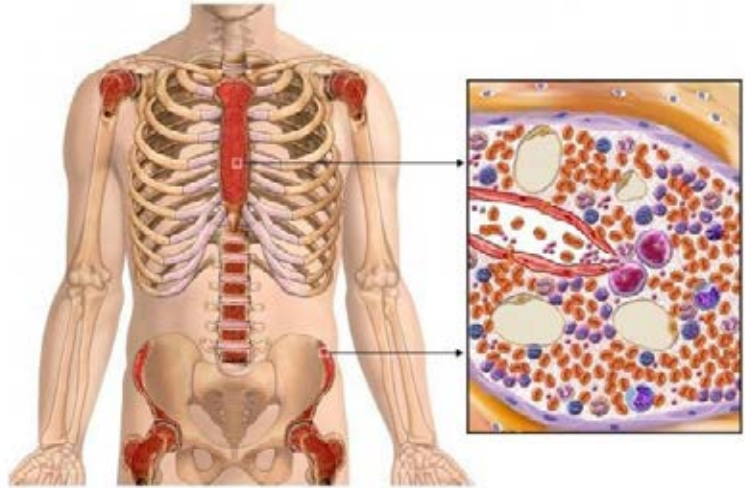


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Figure 2
Blood stem cells make all types of blood cells

Blood stem cells are immature cells from which all types of blood cells are made. B cells are white blood cells that turn into plasma cells.

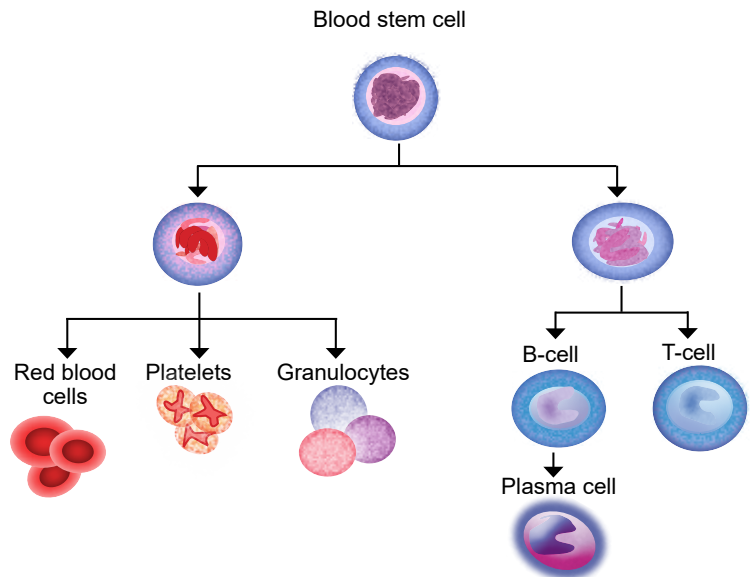


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Multiple myeloma basics

Multiple myeloma (also simply called *myeloma*) is a cancer that starts in plasma cells. Plasma cells grow and then divide to make new cells. New cells are made as the body needs them. When plasma cells grow old or get damaged, they die.

Genes are the instructions in cells for making new cells and controlling how cells behave. Changes in genes turn plasma cells into myeloma cancer cells. An abnormal change in a gene is called a gene mutation or defect.

In contrast to healthy plasma cells, myeloma cancer cells make more and more new cells that aren't needed and don't die quickly when old or damaged. **See Figure 3.** The myeloma cells continue to make millions of copies of themselves. As a result, a group of myeloma cells with the same gene mutation forms, often referred to as a *clone* of cells. Myeloma cells may be spread throughout the bone marrow or form masses growing in one or more spots outside of the bone marrow. These masses can destroy the bone around them as they grow.

- A mass of myeloma cells is called a **plasmacytoma**.
- When there is only one mass of myeloma cells, it is called a **solitary plasmacytoma**.
- When myeloma cells grow and spread throughout the bone marrow, it is called **multiple myeloma**.

The myeloma cells can crowd out normal blood cells in the bone marrow, destroy bone tissue, and spread all over the body. It is not fully known why a normal plasma cell changes into a myeloma cancer cell.

M-proteins

Like plasma cells, myeloma cells also make antibodies. But, the antibodies made by myeloma cells are all copies of one specific type of antibody. Since they are made by a clone of myeloma cells, they are called *monoclonal proteins* or *M-proteins*. Myeloma cells make M-proteins without control and not in response to a specific germ in the body. M-proteins don't help to fight infections.

In most patients, myeloma cells make very large amounts of M-proteins. Rarely, the myeloma cells make very little or no M-protein. This is called *oligosecretory* or *nonsecretory myeloma*.

Normal antibodies are made of two heavy protein chains and two light protein chains. **See Figure 4.** Heavy chains are one of five types—A, D, G, E, or M. Light chains are one of two types—kappa or lambda. The form of heavy chain defines the type of antibody.

Like normal antibodies, M-proteins are also made of two heavy chains and two light chains. However, myeloma cells tend to make more light chains than needed to form a complete M-protein. This leads to excess light chains that aren't attached to a heavy chain. These are called free light chains. High levels of free light chains are found in the urine of some people with myeloma.

The light chains from M-proteins found in the urine are also called Bence Jones proteins. In about 15 out of 100 people with myeloma, the myeloma cells only make light chains and no complete M-proteins. Doctors call this *light chain myeloma* or *Bence Jones myeloma*.

Figure 3 Plasma cell versus myeloma cell growth

Normal cells grow and divide to make new cells as the body needs them. Normal cells die when they are old or damaged. New cells are then made to replace the old. Myeloma cells don't die when they should. Instead, they continue to grow and divide to make more and more copies of themselves.

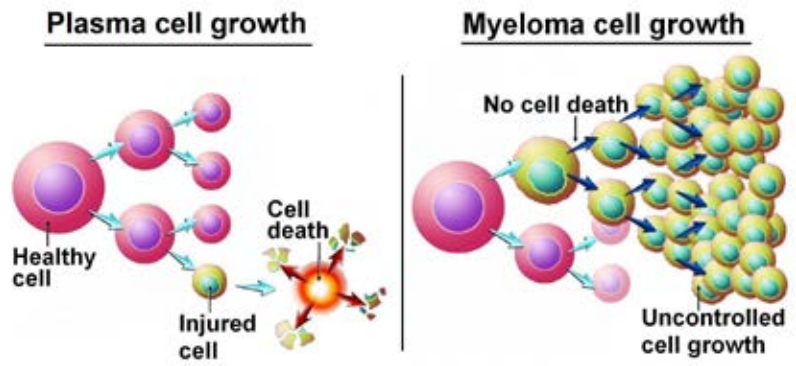


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Figure 4 Antibodies made by a plasma cell versus a myeloma cell

Antibodies are y-shaped proteins that are made by normal plasma cells and by myeloma cells. Normal antibodies are made of two heavy protein chains and two light protein chains. Different types of antibodies are needed to fight different types of germs and infections. People with healthy plasma cells make all these different types of antibodies. But, myeloma cells make only one type of antibody—called M-protein. Myeloma cells also tend to make too many light chains.

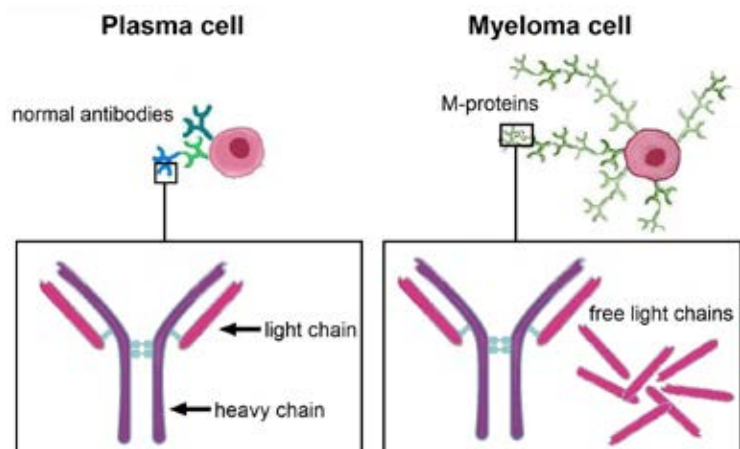


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Symptoms of myeloma

In a healthy person, there are plenty of normal blood cells and normal amounts of all five types of antibodies. In a person with myeloma, fewer normal blood cells are made when the bone marrow is full of myeloma cells. Likewise, normal antibodies are outnumbered by the one type of abnormal antibody—M-protein—made by the myeloma cells. As a result, symptoms of the myeloma will appear.

When myeloma is causing symptoms or affecting organs, it is called *active (symptomatic) myeloma*. Symptomatic myeloma should be treated. Even without symptoms or damage to body organs, myeloma with certain lab test results that suggest it will soon cause symptoms also requires treatment. Such lab test results include the amount of plasma cells in the bone marrow, the amount of abnormal light chain, and the number of painless bone lesions.

When myeloma isn't causing symptoms and does not have lab test results that require treatment, it is called *smoldering (asymptomatic) myeloma*. Patients may also have small amounts of M-protein and smaller numbers of abnormal plasma cells in the bone marrow without any symptoms, a condition referred to as MGUS (**m**onoclonal **g**ammopathy of **u**ndetermined **s**ignificance). Some of the most common symptoms of active myeloma are described next.

Fatigue and feeling weak

Fatigue is severe tiredness despite getting enough sleep and rest. Fatigue and feeling weak are symptoms of anemia. Anemia is a condition in which the amount of hemoglobin in the red blood cells is low. Anemia can be caused by too many myeloma cells crowding out growing red blood cells in the bone marrow.

Figure 5 Common areas of bone damage by myeloma

Myeloma cells can damage bone. This damage can cause bones to break (fracture) easily. Common sites of bone damage from myeloma are the spine, skull, hip bone, ribs, arms, and collarbone.

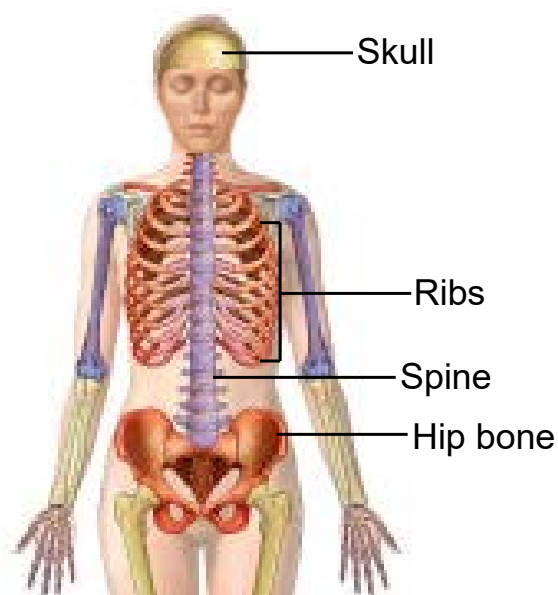


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Bruising or bleeding easily

Platelets are blood cells that help heal wounds and stop bleeding. They do this by forming blood clots. Bruising or bleeding easily is a symptom of having a low number of platelets. Too many myeloma cells in the bone marrow can crowd out the cells that make platelets.

Frequent infections and fevers

Fever is a sign that your body is trying to fight off an infection. Frequent fevers and infections are symptoms of having too few white blood cells, but this can also be due to low levels of normal antibodies. A low number of white blood cells can result from too many myeloma cells in the bone marrow.

Bone damage and pain

Myeloma cells can cause bone damage when they crowd out normal cells in the bone marrow. They also release chemicals that begin to break down bone. Areas of bone damage are called *bone lesions* and can be very painful. Bone lesions also weaken bones so they may break (fracture) easily.

Common sites of bone damage from myeloma are the spine, skull, hip bone, ribs, arms, and collarbone.

See Figure 5. The most common fracture site is in the bones (vertebrae) of the spine. Fractures of the vertebrae can be very painful, but they can also occur without any pain.

Kidney problems

The kidneys are a pair of organs that filter blood to remove waste, which leaves the body in urine. Increased or decreased urine output is a symptom of kidney damage. The high levels of M-proteins made by the myeloma cells can cause kidney damage.

Myeloma can damage bones, and this bone damage causes calcium to be released into the bloodstream. Calcium is a mineral needed for healthy bones.

But, high levels of calcium in the bloodstream can damage the kidneys and cause other symptoms.

Review

- Myeloma is a cancer of plasma cells.
- Plasma cells make antibodies that help to fight infections and play a key role in bone repair.
- Myeloma cells make too many copies of themselves.
- Myeloma cells make abnormal antibodies called M-proteins that don't help to fight germs.
- One mass of myeloma cells is called a solitary plasmacytoma.
- When myeloma cells have spread throughout the bone marrow, it is called multiple myeloma.
- Smoldering (asymptomatic) myeloma doesn't cause symptoms.
- Active (symptomatic) myeloma causes symptoms by taking over bone marrow and may cause high blood calcium, kidney damage, or anemia, or may destroy bone.

2

Testing for myeloma

15 General health tests

15 Blood tests

18 Urine tests

19 Tissue tests

21 Imaging tests

23 Review



Treatment planning starts with testing. This chapter describes the tests that are used to confirm (diagnose) myeloma and plan treatment. This information can help you use the *Treatment guide* in Part 4. It may also help you know what to expect during testing. Not every person with myeloma will receive every test listed.

General health tests

Medical history

Your medical history includes all health events in your life and any medicines you've taken. You will be asked about any illnesses, injuries, and health problems you've had. Some health problems run in families. So, your doctor may also ask about the health of your blood relatives.

Myeloma may cause symptoms. It's important that your doctor knows if you have them. Symptoms may result from a shortage of healthy blood cells. Or, they may result from myeloma cells collecting in certain parts of the body or the damage to the bones. But, some patients may have few or no symptoms at all.

A medical history is needed for treatment planning. [See Guide 1](#) on page 16 for a full list of the tests that are recommended before treatment for myeloma. It is important to make a list of old and new medicines while at home to bring to your doctor's office.

Physical exam

Doctors often perform a physical exam along with taking a medical history. A physical exam is a review of your body for signs of disease.

During this exam, your doctor will listen to your lungs, heart, and gut. Parts of your body will likely be felt to see if organs are of normal size, are soft or hard, or cause pain when touched.

Blood tests

Doctors test blood to look for signs of myeloma in the bloodstream. Blood tests are done along with other initial tests to help confirm (diagnose) myeloma. Blood is made of red blood cells, white blood cells, and platelets. It also has many proteins and other chemicals. Different types of blood tests are used to look for and measure different substances in the blood. These tests help doctors learn more about the myeloma and your health.

Some blood tests are used to assess the extent or amount of myeloma in your body. This is referred to as the tumor burden. Other tests are used to check the health of your bones, kidneys, and other organs. Blood tests may be repeated sometimes to check how well cancer treatment is working and to check for side effects.

For a blood test, your doctor will insert a needle into your vein to remove a sample of blood. The blood sample will then be sent to a lab for testing. The blood tests that are used for myeloma are described next.

CBC with differential

A CBC (complete blood count) is a test that measures the number of blood cells in a blood sample. It includes the number of white blood cells, red blood cells, and platelets. The CBC should include a differential. The differential measures the different types of white blood cells in the sample. As myeloma cells take over the bone marrow, too few normal blood cells are made.

Guide 1. Tests for multiple myeloma

Initial tests needed for most patients	Tests that may be useful for some patients
Medical history and physical exam	Tissue biopsy for solitary plasmacytoma
CBC with differential and platelet count	Plasma cell proliferation
Examination of peripheral blood smear	Whole-body or skeletal MRI (magnetic resonance imaging)
Blood chemistry tests: BUN (blood urea nitrogen), creatinine, creatinine clearance, electrolytes, calcium, albumin	Whole-body FDG (fluorodeoxyglucose) PET/CT (positron emission tomography/computed tomography) scan
Uric acid	Serum viscosity
LDH (lactate dehydrogenase)	HLA (human leukocyte antigen) typing
Beta-2 microglobulin	Echocardiogram
Serum FLC (free light chain) assay	Evaluation for light chain amyloidosis
Serum quantitative immunoglobulins	
SPEP (serum protein electrophoresis)	
SIFE (serum immunofixation electrophoresis)	
24-hour urine for total protein	
UPEP (urine protein electrophoresis)	
UIFE (urine immunofixation electrophoresis)	
Bone survey or whole-body low-dose CT (computed tomography) scan	
Bone marrow biopsy and aspiration	
Bone marrow immunohistochemistry and/or bone marrow flow cytometry	
Cytogenetics testing on bone marrow	
Plasma cell FISH (fluorescence in situ hybridization)	

If you have abnormal CBC test results, a pathologist may also look at the blood sample on a glass slide under a microscope (peripheral blood smear). A pathologist is an expert in examining cells for disease. He or she can see the blood cells in more detail for a diagnosis of multiple myeloma. They may be able to observe myeloma cells in the blood.

Blood chemistry tests

Blood chemistry tests measure the levels of different chemicals in your blood. Chemicals in your blood come from your liver, bone, and other organs and tissues. Abnormal levels of certain chemicals in the blood may be a sign that an organ isn't working well. These abnormal levels can also be caused by cancer or other health problems. The main substances your doctors will assess for with chemistry tests are described next.

BUN

BUN is a waste product made by the liver and filtered out of blood into urine by the kidneys. BUN is measured with a blood chemistry test. High levels in the blood may be a sign of kidney damage.

Creatinine

Creatinine is waste from muscles that is filtered out of blood into urine by the kidneys. It is measured with a blood chemistry test. High levels of creatinine in the blood may be a sign of kidney damage.

It is recommended that your doctor calculate or measure the creatinine clearance. A creatinine clearance involves taking a 24-hour sample of urine and comparing it to the level of creatinine in your blood. This test is needed to see how well your kidneys are working.

Electrolytes

Electrolytes are minerals in the blood that are needed for organs to work well. They are measured with a blood chemistry test.

High levels of electrolytes such as sodium, potassium, and calcium may be a sign of kidney damage.

Calcium

Calcium is a mineral that is found in many body tissues, but mostly in the bones. It is measured with a blood chemistry test. High levels of calcium in the blood may be a sign of myeloma destroying bone. Too much calcium in your blood can damage your kidneys.

Albumin

Albumin is the main protein in blood plasma and is measured with a blood chemistry test. Low levels of this protein may be a sign of advanced myeloma.

LDH

LDH is a protein made by many types of cells, including myeloma cells. It is measured with a blood chemistry test. High levels of LDH may be a sign of advanced myeloma.

Beta-2 microglobulin

Beta-2 microglobulin is a protein made by many types of cells, including myeloma cells. It is measured with a blood chemistry test. High levels of this protein may be a sign of advanced myeloma.

Uric acid

Uric acid is one of the chemicals released by dying cancer cells. Very high levels of uric acid and other chemicals in the blood can be very dangerous. It can cause serious damage to organs such as the kidneys.

Serum quantitative immunoglobulins

This test measures the amount of each type of antibody in the blood. It will show if the level of any type of antibody is abnormal—too high or too low. These are the kinds of antibodies (immunoglobulins) that were mentioned on page 10, called A, G, M, D, and E. Typically, the G, A, and M types of immunoglobulins are tested, as myeloma with other types are uncommon.

Serum free light chain assay

This test measures the amount of free light chains in the blood. This test is helpful even when it isn't possible to measure the amount of M-proteins in the blood or urine using electrophoresis.

SPEP

SPEP is a test that measures the amount of M-proteins in the blood. High levels may be a sign of advanced myeloma.

SIFE

SIFE is a test that finds the type of M-proteins present in the blood. It finds the type of M-proteins by showing which form of heavy chains and light chains they have.

Serum viscosity

Serum viscosity is a blood test that measures the thickness of your blood. A large amount of M-proteins in your blood can cause blood to become very thick—a condition called *hyperviscosity*. This can lead to neurologic symptoms, headaches, vision problems, bleeding, and damage to your kidneys and other organs.

HLA typing

HLAs are special proteins found on the surface of most cells in the body. The unique set of HLA proteins on a person's cells is called the HLA type or tissue type. All cells in a single person have the same HLA type. This helps the body to tell its own cells apart from foreign cells. It also affects how the body responds to foreign substances.

HLA typing is a blood test that finds a person's HLA type. This test is used to find the right donor for an allogeneic stem cell transplant—a treatment that may be considered for some patients with myeloma. (See Part 3 on page 24 for details about this treatment).

Your HLA type and the donor's HLA type must be a near-perfect match for this treatment to work.

Urine tests

Besides blood, doctors also test urine to look for signs of disease. Urine tests can be used to diagnose myeloma, assess if your kidneys are working well, and check the results of cancer treatments. Urine tests are also used to assess the tumor burden—the extent or amount of myeloma in your body. The urine tests that are used for myeloma are described next.

Total protein

Total protein is a test that measures the total amount and type of protein in urine. For this test, urine is collected over a 24-hour period. This test can show the amount of light chains, also called Bence Jones protein, in the urine. Testing 24-hour urine for light chains helps to measure the tumor burden in patients with myeloma cells that mainly or only make light chains.

UPEP

UPEP is a test that measures the amount of M-proteins in the urine. For this test, urine is collected for 24 hours and then sent to a lab for testing. This test is used to assess the tumor burden. It is given along with other initial tests when myeloma is first found. It may also be repeated to check how well treatment is working.

UIFE

UIFE is a test that identifies the type of M-proteins present in urine. This test is used to assess the tumor burden. It is given along with other initial tests when myeloma is first found. It may also be repeated to check how well treatment is working.

Tissue tests

To confirm if you have cancer, a sample of tissue or fluid must be removed from your body for testing. This is called a *biopsy*. A biopsy is generally a safe test and can often be done in about 30 minutes. The types of biopsies used for myeloma are described below.

Bone marrow aspiration and biopsy

A bone marrow biopsy removes a small piece of solid bone along with a small amount of soft bone marrow inside the bone. A bone marrow aspiration removes a small amount of liquid bone marrow from inside the bone. Often, both tests are done at the same time on the back of the hip bone. **See Figure 6.**

You may be given a light sedative before the test. Your doctor will then clean the area of skin where the biopsy will be done. Next, you will receive local anesthesia to numb the area of skin and bone beneath. Once numb, a hollow needle will be inserted into your skin and then pushed into the bone to remove the liquid bone marrow with a syringe. Then, a wider needle will be inserted into the bone and twisted to remove the solid bone and marrow sample. You will notice a pressure feeling as this is happening and you might feel some pain while the samples are being removed. Your skin may be bruised for a few days. The samples will be sent to a lab for testing.

Figure 6 Bone marrow biopsy

Doctors use a bone marrow biopsy and aspiration to remove a sample of bone marrow for testing. These tests are often done at the same time on the hip bone.

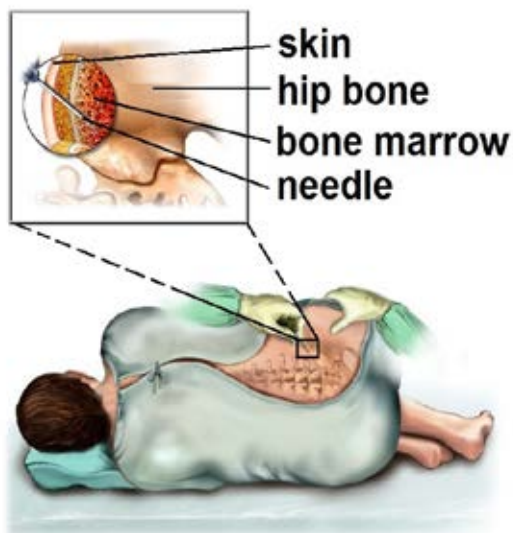


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Tissue biopsy

If you have a solitary plasmacytoma, a tissue biopsy may be done to remove a sample of the mass for testing. The sample is often removed with a needle. This can be done with an FNA (fine-needle aspiration) biopsy or with a core needle biopsy.

An FNA biopsy uses a very thin needle to remove a small sample from the mass. A core needle biopsy uses a larger needle to collect a larger sample of tissue. For a tissue biopsy, an imaging test may be used to guide the needle through the skin and into the mass.

Lab tests

After the tissue samples are collected, they will be sent to a lab for testing. A pathologist will view the samples under a microscope to look for myeloma cells. The pathologist may also perform other tests on the samples. It often takes several days before the test results are known. The lab tests that may be performed on the tissue samples are described next.

Flow cytometry

This is a test that measures the amount of myeloma cells in the bone marrow. This test can tell the difference between normal plasma cells and abnormal plasma cells (myeloma cells).

Immunohistochemistry

This test is performed on the bone marrow biopsy sample. It is used to measure the number of myeloma cells in the bone marrow.

Genetic tests

Genetic tests are used to check for abnormal chromosomes and genes. Different types of tests are done with the cells. First, bone marrow cells are grown to make the cells divide. Next, the dividing cells can be examined.

Cytogenetic testing uses a microscope to examine the chromosomes inside cells. This type of test is used to look for abnormal changes in the chromosomes of the myeloma cells. For myeloma, this is done on a sample of bone marrow.

While examining the cells, a pathologist will also look at a “map” of the chromosomes under a microscope. This is called *karyotyping*. It will show if there are any abnormal changes in the size, shape, structure, or number of chromosomes.

Myeloma cells can also be examined with a test called FISH. FISH uses probes that attach to certain parts of the chromosomes known to be affected in myeloma. FISH testing is very important to determine whether a patient’s myeloma can be considered standard risk or high risk. The newest testing, called *gene expression*, looks for certain genes that may be turned on or turned off in myeloma cells. This is not routinely performed.

Plasma cell proliferation

This test shows what percentage of the myeloma cells are dividing. A larger number of cells dividing is a sign that the cancer will grow fast.

Light chain amyloidosis

Amyloid is a rare protein found in people with abnormal plasma cells that make abnormally folded light chains. Amyloid can collect and build up in tissues and organs throughout the body. The buildup of amyloid, called *amyloidosis*, can damage organs such as the heart and kidneys. Tests for light chain amyloidosis can be done on a sample of bone marrow, the fat pad—fat from just under the skin of the belly, or other biopsy of an organ with amyloid deposits.

Imaging tests

Imaging tests take pictures (images) of the inside of your body. These tests are often easy to undergo. Before the test, you may be asked to stop eating or drinking for several hours. You should also remove any metal objects that are on your body.

Imaging machines are large and may be very noisy. You will likely be lying down during testing. At least part of your body will be in the machine. Figure 7 on page 22 shows one type of imaging machine.

Some imaging tests may use a contrast dye to make the pictures clearer. This contrast dye can cause damage to frail kidneys. Thus, it should be used with great care in patients with multiple myeloma. The types of imaging tests used for multiple myeloma are described below.

Bone survey

A bone survey—also called a skeletal survey—is a test that uses a set of x-rays to take pictures of your entire skeleton. A bone survey is done to check for broken or damaged bones caused by myeloma.

MRI scan

MRI uses radio waves and powerful magnets to take pictures of the inside of the body. It makes pictures of bone and bone marrow. This type of scan may show abnormal areas where myeloma cells have replaced bone marrow. An MRI scan of your whole body may be given when the bone survey doesn't show any problems.

These large machines are quite noisy, and you might want to bring ear protection from home. Only use plastic protectors and not any that contain metal. The loud, strange sounds in the machine are normal. When you are lying in the machine it might seem to be very close to your face. It works best to close your eyes and relax while the machine is working. Your doctor can prescribe a mild sedative to help you relax. You should let your health care provider know if you are claustrophobic or afraid of closed spaces.

Your medical records:

- ✓ Your doctors will order tests and schedule visits to talk about your care plan.
- ✓ It is helpful to keep track of your test results at all times. Ask your doctors questions about the results.

Low-dose CT scan

CT takes many pictures of a body part from different angles using x-rays. **See Figure 7.** A computer combines all the pictures to make one clear picture. The amount of radiation used for this type of scan is much lower than standard doses of a CT scan.

A low-dose CT scan may be used to check the whole body. It can show whether or not lytic bone lesions are present. Lytic bone lesions look as if the bone has been eaten away. These lesions may cause pain and weaken the bones. Since bone lesions are common for people with multiple myeloma, an imaging test such as a whole-body low-dose CT scan or bone survey is recommended.

PET/CT scan

PET and CT are two types of imaging tests. These tests are often done at the same time. When used together, it is called a PET/CT scan. A PET/CT scan may be done with one or two machines depending on the cancer center. PET/CT is a test that may be used when a bone survey doesn't show any problems.

PET shows how your cells are using a simple form of sugar. To create pictures, a sugar radiotracer first needs to be put into your body through a vein. The radiotracer emits a small amount of energy that is detected by the machine that takes pictures. Myeloma cells appear brighter in the pictures because they use sugar more quickly than normal cells. A PET scan is very good at showing active myeloma and how far it has spread. It can also help show bone damage from myeloma.

The most commonly used radiotracer is called FDG. NCCN experts recommend that FDG be used when a PET/CT scan is being done.

Figure 7. CT scan machine

A CT scan machine is large and has a tunnel in the middle. During the test, you will lie on a table that moves slowly through the tunnel.



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Echocardiogram

An echocardiogram is an imaging test of your heart. It uses sound waves to make pictures. This test is used to check how well your heart is working. It shows your doctor how well your heart is beating and pumping blood.

Review

- Cancer tests are used to make a diagnosis, plan treatment, and check how well treatment is working.
- Your health history and a body exam inform your doctor about your health.
- Blood and urine tests check for signs of disease.
- Tests of tissue or fluid from the bone marrow are used to confirm myeloma.
- Tests that take pictures of the inside of your body may show bone damage from the cancer. These pictures can also show spots of myeloma cancer growth that are outside of your bones.

3

Overview of myeloma treatments

25 Radiation therapy

25 Surgery

28 Targeted therapy

28 Chemotherapy

29 Steroids

29 Stem cell transplant

33 Adjunctive treatment and supportive care

34 Clinical trials

37 Review



This chapter describes the main treatments for multiple myeloma and its symptoms. Knowing what a treatment is will help you understand your treatment options listed in the *Treatment guide* in Part 4. There is more than one treatment for myeloma. Not every person with myeloma will receive every treatment listed in this chapter.

Radiation therapy

Radiation therapy is a type of local therapy. Local therapy treats cancer cells in one small, specific area of the body only. In myeloma, radiation therapy is most commonly used to treat an area of bone damage that is painful or a plasmacytoma that is causing pain. Radiation therapy can be used as the only treatment for solitary plasmacytomas. A solitary plasmacytoma is a single mass of myeloma cells.

Radiation therapy uses high-energy rays to treat cancer. The rays damage the genes in cells. This either kills the cancer cells or stops new cancer cells from being made. EBRT (external beam radiation therapy) is the most common type of radiation therapy used to treat solitary plasmacytomas. For EBRT, a machine outside the body delivers radiation to the cancer site.

Side effects of radiation therapy

A side effect is an unhealthy or unpleasant physical or emotional condition caused by treatment. Side effects of radiation therapy may not occur in the first few visits. Over time, you may have nausea, diarrhea, and fatigue. You may lose your appetite and may even lose weight during treatment. Other common side effects are changes in your skin and hair loss in the treated area.

Surgery

Surgery is an operation to remove or repair a body part. It is a type of local therapy. Surgery can be used to remove a solitary plasmacytoma located outside of the bone if it is causing symptoms and can't be treated with radiation alone. Radiation therapy may be given before or after the surgery. Surgery may also be used to fix fractures in bones caused by myeloma.

Side effects of surgery

You may experience weakness, tiredness, and pain after the surgery. Other common side effects are swelling, surgical scars, and, less frequently, infections.

Order of treatments

Most people with myeloma will receive more than one type of treatment. When and why treatments are given can be hard to understand. Part 4 gives full details. Here, the terms that describe the order of treatments are explained.

Primary treatment

The first treatment given to try to rid the body of cancer. Also referred to as induction treatment.

Maintenance treatment

Treatment given to keep cancer cells suppressed after prior treatments worked well.

Additional treatment

Treatment given after prior treatments failed to kill all of the cancer or keep it away. Also referred to as salvage treatment.

Guide 2. Drug treatment for multiple myeloma

Generic name	Brand name (sold as)	Type of treatment
Bendamustine	Bendeka, [™] Treanda [®]	Chemotherapy
Bortezomib	Velcade [®]	Targeted therapy (proteasome inhibitor)
Carfilzomib	Kyprolis [®]	Targeted therapy (proteasome inhibitor)
Cisplatin	–	Chemotherapy
Cyclophosphamide	–	Chemotherapy
Daratumumab	Darzalex [®]	Monoclonal antibody
Dexamethasone	–	Steroid
Doxorubicin hydrochloride	–	Chemotherapy
Doxorubicin hydrochloride liposome	DOXIL [®]	Chemotherapy
Elotuzumab	Empliciti [™]	Monoclonal antibody
Etoposide	Etopophos [®]	Chemotherapy
Ixazomib	Ninlaro [®]	Targeted therapy (proteasome inhibitor)
Lenalidomide	Revlimid [®]	Immunomodulator
Melphalan	Alkeran [®]	Chemotherapy
Panobinostat	Farydak [®]	Targeted therapy (HDAC [histone deacetylase] inhibitor)
Pomalidomide	Pomalyst [®]	Immunomodulator
Thalidomide	Thalomid [®]	Immunomodulator

Targeted therapy

Targeted therapy is treatment with drugs that target a specific or unique feature of cancer cells. Because these drugs specifically target cancer cells, they may be less likely to harm normal cells throughout your body. [Guide 2](#) lists the targeted therapy drugs and other drugs that are used to treat myeloma.

Targeted therapy drugs treat myeloma in different ways. Some block the growth of new blood vessels that feed myeloma cells in the bone marrow. These are called *angiogenesis inhibitors*. Others block the action of groups of proteins (proteasomes) that allow the myeloma cells to survive. These drugs are called *proteasome inhibitors*. Another type blocks the action of histone deacetylase enzymes and may cause cell death. These are called *HDAC inhibitors*.

Monoclonal antibodies are another type of targeted therapy. These drugs are man-made antibodies that attach to proteins on cancer cells. An immunomodulator is a type of targeted therapy drug that helps the immune system find and attack cancer cells.

Side effects of targeted therapy

A side effect is an unhealthy or unpleasant physical or emotional condition caused by treatment. Each treatment for myeloma can cause side effects. The reactions to treatment differ between people. Some people have many side effects. Others have few. Some side effects can be very serious while others can be unpleasant but not serious. Most side effects appear soon after treatment starts and go away after treatment ends. But, other side effects are long-term and may appear years later.

The side effects of targeted therapy depend on the drug and dose. Some of the side effects listed are caused by only one targeted drug. Others are caused by many targeted drugs but differ in how likely they are to occur.

Some common side effects of targeted therapy drugs used for myeloma are tiredness, weakness, nausea or vomiting, diarrhea, and constipation. These drugs may also cause a low number of red blood cells, white blood cells, or platelets. A low white blood cell count can increase risk of infection. A low platelet count can increase risk of bruising and bleeding. Other common side effects are blood clots, numbness or tingling in the hands or feet, skin rash, and muscle aches.

Not all side effects of targeted therapy drugs are listed here. Be sure to 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.

Chemotherapy

Chemotherapy is the use of drugs to kill cancer cells. Many people refer to this treatment as “chemo.” Chemotherapy drugs kill fast-growing cells throughout the body, including cancer cells and normal cells. Some chemotherapy drugs can also cause damage to your bone marrow.

Different types of chemotherapy drugs work in different ways to kill cancer cells or stop new ones from being made. Thus, more than one drug is often used. When only one drug is used, it's called a single agent. A combination regimen is the use of two or more cancer drugs.

Chemotherapy is given in cycles of treatment days followed by days of rest. This allows the body to recover before the next treatment cycle. Cycles vary in length depending on which drugs are used. Often, the cycles are 14, 21, or 28 days long. The number of treatment days per cycle and the total number of cycles given also varies based on the regimen used.

Many of the chemotherapy drugs listed in [Guide 2](#) are liquids that are slowly injected into a vein. Some are a pill that is swallowed. The drugs travel in the bloodstream to treat cancer throughout the body. This is called *systemic therapy*.

Side effects of chemotherapy

Like targeted therapy, the side effects of chemotherapy depend on many factors. This includes the drug, the dose, and the person. In general, side effects are caused by the death of fast-growing cells, which are found in the intestines, mouth, and blood. Common side effects of chemotherapy are nausea, vomiting, diarrhea, mouth sores, not feeling hungry, hair loss, and low blood cell counts. Feeling very tired (fatigue) or weak is also common.

Not all side effects of chemotherapy are listed here. Be sure to 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.

Steroids

Steroids are a type of drug used to relieve swelling and inflammation, but some steroids have anti-cancer effects. Steroids are often used in the treatment of myeloma because of their anti-cancer effects. Steroids can be used alone to treat myeloma or used with chemotherapy, targeted therapy, or both. See [Guide 2](#) on page 27.

Side effects of steroids

Most side effects of steroids go away over time once the drugs are stopped. Some common side effects are feeling hungry, trouble sleeping, slow wound healing, upset stomach, and swelling in the ankles, feet, and hands. Steroids also make some people

feel irritable and cranky. Changes in mood can happen from day to day. When used for a long time steroids can lead to weakening of bones, thinning of skin, weight gain, and an increased risk of infections.

Stem cell transplant

Blood stem cells are cells that develop into all types of mature blood cells. Blood stem cells and mature blood cells are made in bone marrow. Cancer or its treatment can damage or destroy cells in the bone marrow. A stem cell transplant is a treatment that replaces the damaged or destroyed cells in the bone marrow with healthy blood stem cells.

The goal of a stem cell transplant is to treat cancer by giving powerful chemotherapy and then replacing the stem cells to allow the bone marrow to recover. This is done by suppressing the bone marrow and cancer with chemotherapy then transplanting healthy blood stem cells. The healthy blood stem cells will grow and form new bone marrow and blood cells.

There are two main types of stem cell transplants. An *autologous* stem cell transplant uses your own blood stem cells to regrow bone marrow after high-dose chemotherapy. An *allogeneic* stem cell transplant uses blood stem cells that come from another person (donor). See page 32 for more details about the types of stem cell transplants. The steps of treatment with a stem cell transplant are described next.

Collecting the stem cells

The first step of a stem cell transplant is to collect, or harvest, the blood stem cells. Blood stem cells are found in the bone marrow and in the bloodstream. For myeloma treatment, blood stem cells are usually taken from the blood.

Your doctor will likely collect enough blood stem cells for two transplant procedures in case they're needed as an option for future treatment.

If blood stem cells will be taken from the blood, then a process called *apheresis* will be done. First, medicine will be given to increase the number of blood stem cells in the blood. Then, some blood will be removed from a large vein (most likely in your arm). The blood will flow through a tube and into a machine that removes the blood stem cells. The rest of the blood will be returned through a tube in the other arm.

Apheresis typically takes 4 to 6 hours and does not require anesthesia. It may take a few sessions to obtain enough blood stem cells. This procedure may cause lightheadedness, chills, numbness around the lips, and cramping in the hands.

If blood stem cells will be taken from bone marrow, then bone marrow aspirations will be used. For this procedure, general anesthesia will be given. Next, a needle will be inserted through the skin into the hip bone to draw out the bone marrow. The needle must be inserted many times into one or more spots in the bone to collect enough bone marrow. The bone marrow will then be processed to collect the blood stem cells.

Collection of the bone marrow takes about 1 to 2 hours. You may be observed in the hospital overnight. The aspiration will likely cause some pain and soreness for a few days. Anesthesia may cause nausea, headache, and tiredness. Blood stem cells are very rarely collected from bone marrow in patients with myeloma. Most often, they are taken from the blood as described above.

After apheresis or aspiration, the harvested blood stem cells will be combined with a preservative. Then, they will be frozen and stored to keep them alive until the transplant. This process is called *cryopreservation*.

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High-dose chemotherapy

Before the transplant, you will receive high-dose chemotherapy. This is called *conditioning treatment* since it prepares (conditions) your body to receive the blood stem cells that were collected earlier.

The chemotherapy is given to destroy any remaining myeloma cells in your bone marrow. But, it also destroys normal cells in your bone marrow. This greatly weakens your immune system so that your body doesn't kill the transplanted blood stem cells when the cells are coming from a donor.

However, not every person can tolerate the high-dose chemotherapy before the transplant. If a stem cell transplant is being considered, your doctor will do a lot of tests of your heart, lungs, kidneys, and general health before deciding if you can handle this kind of treatment.

Transplanting the stem cells

After the chemotherapy, the blood stem cells will be put into your body with a transfusion. A transfusion is a slow injection of blood products into a large vein. This process can take several hours to complete.

The transplanted stem cells will then travel to your bone marrow and grow. They will make new, healthy blood cells. This is called *engraftment*. It usually takes about 2 to 4 weeks.

Until then you will have little or no immune defense. This puts you at high risk for infection and bleeding. You may need to stay in a hospital in a very clean room for some time. It may take a few weeks or months for blood cells to fully recover so that your immune system is back to normal.

Side effects of stem cell transplant

A side effect is an unhealthy or unpleasant physical or emotional condition caused by treatment. Common side effects of chemotherapy are described on page 29.

After chemotherapy, blood counts can be very low leading to increased risk of infections and bleeding. The high dose of chemotherapy can result in nausea, vomiting, diarrhea, and mouth sores. You will likely feel tired and weak shortly after the transplant while waiting for the new blood stem cells to grow in the bone marrow. This weak and unpleasant feeling might last for several weeks after you go home, too.

Allogeneic stem cell transplants have a high risk of GVHD (**graft-versus-host disease**). GVHD is when the donated cells see the cells in your body as foreign and attack them. The parts of the body most commonly damaged by GVHD are the skin, intestines, muscles, joints, eyes, and liver.

GVHD is a serious side effect that can cause the transplant to fail by stopping the donated blood stem cells from growing in your bone marrow. GVHD can happen within a few weeks after the allogeneic transplant or much later. Your doctor will give you medicine that suppresses your immune system to try to prevent this side effect. You may also receive other drugs as needed to treat GVHD.



I never feel alone as my oncology team really cares about me. They include my doctor and the entire nursing team.

- Robin

Helpful tips:

- ✓ Keep a list of contact information of all of your health care providers.
- ✓ Use a calendar or ask a caregiver to make note of your treatment schedule and follow-up appointments.

Types of stem cell transplants

Autologous stem cell transplant

This transplant uses your own blood stem cells that are collected after primary treatment or high-dose therapy. The intent is to use high doses of chemotherapy to kill the maximum amount of myeloma cells and then help the bone marrow recover by putting the blood stem cells back into your bloodstream. From there, they travel to your bone marrow and grow. Autologous stem cell transplant is the most common type of transplant used for active (symptomatic) myeloma. But, it is not considered a cure because the myeloma may come back even after long periods of disease control.

Tandem stem cell transplant

A tandem transplant is when a planned second round of high-dose chemotherapy and a second stem cell transplant are given after the first autologous transplant. The second transplant can be autologous or allogeneic. It is typically done within 6 months after the first transplant.

Allogeneic stem cell transplant

This type of transplant uses blood stem cells from another person, called a donor. Before the transplant, HLA typing is needed to check if you and the donor are a good match. See page 18 for more details on HLA typing.

This transplant may provide the best chance to cure myeloma, although chances are low. A cure

may be possible because the donor's healthy blood stem cells create a new immune system for your body. Another benefit of this transplant is the GVT (**graft-versus-tumor**) effect. The GVT effect is an attack on the myeloma cells by the transplanted donor blood stem cells.

Allogeneic stem cell transplants aren't used very often for three reasons. First, it's hard to find a matching donor. Second, side effects are serious and can include death. Third, the risk of the myeloma coming back is still high.

Donor lymphocyte infusion

A donor lymphocyte infusion is a procedure in which the patient receives lymphocytes from the same person who donated blood stem cells for the original allogeneic transplant. A lymphocyte is a type of white blood cell that helps the body fight infections. The purpose of a donor lymphocyte infusion is to stimulate the GVT effect. This treatment may be used if the myeloma comes back after the first allogeneic stem cell transplant.

Mini transplant

This is a type of allogeneic transplant. It is called a "mini" transplant because lower doses of chemotherapy, radiation therapy, or both are given before the transplant. The goal of a mini transplant is to still have the GVT effect but with less severe side effects.

Adjunctive treatment and supportive care

Adjunctive treatment is another treatment given at the same time as the main (primary) cancer treatment. It is given to “assist” the main treatment by improving its safety or how well it works. For myeloma, adjunctive treatment includes supportive care to manage the symptoms of myeloma and side effects of myeloma treatment. It is an important part of overall myeloma treatment. Some of the ways to treat the health problems caused by myeloma and myeloma treatment are described on the next pages.

Bone damage

Multiple myeloma often weakens and destroys bones. This can lead to problems such as bone pain, bone fractures, and compression of the spine. There are medicines that can help strengthen bones and reduce the risk of bone problems, such as fractures.

Drugs called bisphosphonates are one type of medicine that can improve bone health. They are given as a liquid that is injected into a vein—called an IV (intravenous) infusion. Pamidronate disodium (Aredia®) and zoledronic acid (Zometa®) are bisphosphonates commonly used with multiple myeloma therapy. A different type of drug called denosumab (XGEVA®) can help prevent serious bone problems in people with multiple myeloma. Denosumab is given as a shot (injection) under the skin every four weeks.

NCCN experts recommend that either bisphosphonates or denosumab be given to all patients receiving primary treatment for myeloma. Denosumab is a better choice than bisphosphonates for people whose kidneys don’t work well.

Bisphosphonates and denosumab can cause side effects, such as osteonecrosis of the jaw. It is very important to see your dentist before starting this kind of treatment. It is also very important to have good

dental care before and during treatment with these medicines.

You may be referred to an orthopedic surgeon to help prevent or treat a bone fracture. Surgeons can prevent bone fractures by placing a rod to support the bone and hold it in place. Surgery may be used to treat fractures in the bones of the spine—called *vertebrae*. Two similar procedures that may be used are vertebroplasty and kyphoplasty.

Vertebroplasty is used to treat compression fractures in the bones of the spine. A compression fracture is a break in a bone caused by the collapse of bones in the spine. This surgery involves injecting a type of cement into the bones. The cement supports and strengthens the bones for pain relief and to hold them in place.

With kyphoplasty, a balloon-like device is placed in the fractured vertebrae and then inflated. This spreads out the vertebrae to restore the normal shape and height of the spine. Then the balloon is removed and a type of cement is injected to support the vertebrae and hold them in place.

Bone damage can be painful. Radiation therapy can be used to treat this pain.

Kidney damage

Myeloma cells cause calcium to be released from the bone into the bloodstream. A high level of calcium in the blood is dangerous for the kidneys. If this happens, you will be treated with IV fluids and other drugs to help your kidneys flush out the calcium.

Very high levels of M-proteins can cause the blood to become very thick. This is called *hyperviscosity*. Very thick blood can damage the kidneys and other organs. It can be treated by filtering blood through a machine to remove M-proteins. This treatment is called *plasmapheresis*.

High levels of abnormal M-protein, including light chains (Bence Jones protein), can also damage the kidneys. Free light chains combine with another protein in the kidneys. This causes them to be too large to pass through the kidneys. The damage caused by this blockage is called *myeloma kidney*. Prompt treatment of myeloma is required to prevent permanent kidney damage.

To prevent kidney failure, your doctor may recommend staying hydrated. This means drinking plenty of fluids, especially water. He or she may ask you to avoid using certain medications (NSAIDs [nonsteroidal anti-inflammatory drugs]) and IV contrast, which is often given before an imaging test. Your doctor will watch you closely for signs of kidney damage, especially if you are taking bisphosphonates for a long time.

Anemia

Myeloma cells may crowd out the normal blood cells in the bone marrow. This can cause anemia—a condition in which the number of red blood cells is too low. With treatment of myeloma, the anemia will improve. Sometimes anemia may be treated with a drug called *erythropoietin*. Erythropoietin helps the bone marrow to make more red blood cells.

Your doctor will measure your blood cell levels at different times of your care. He or she may also do a “type and screen” test to make sure your red blood cells will not react to a donor’s blood during a transfusion. This should also be done before receiving treatment with daratumumab.

Infections

Myeloma and certain myeloma treatments can increase the risk of infection. The risk of infection can be reduced with vaccines for pneumonia, the flu, and shingles. Shingles is an infection that causes a painful skin rash. Shingles can be a side effect of bortezomib, carfilzomib, ixazomib, and daratumumab. You might be given pills to take

to prevent shingles from starting while you are getting these myeloma treatments. Intravenous immunoglobulins may be given to prevent frequent and serious infections.

Blood clots

Some drugs, specifically thalidomide, lenalidomide, and pomalidomide, can cause serious blood clots. If these drugs are used, then treatment with blood thinners or antiplatelet agents may be needed. Blood thinners are medicines that thin out the blood to lower the risk of blood clots. NCCN experts recommend taking aspirin while being treated with these immunomodulators; however, talk with your doctor before taking any new medication—even a drug such as aspirin.

Clinical trials

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.

Clinical trials study how safe and helpful tests and treatments are. 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 myeloma. 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 to make sure 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 are done in four steps, called phases. Some examples of the four phases of clinical trials for treatment are:

- ▶ **Phase I trials** aim to find the best dose and way to give a new drug with the fewest side effects.
- ▶ **Phase II trials** assess if a drug works to treat a specific type of cancer.
- ▶ **Phase III trials** compare a new drug to the standard treatment.
- ▶ **Phase IV trials** test new drugs approved by the FDA (U.S. Food and Drug Administration) in many patients with different types of cancer.

Joining a clinical trial has benefits. First, you'll have access to the most current cancer care. 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 other test or treatment, there may be side effects. Also, new tests or treatments may not help. Another downside may be that paperwork or more trips to the hospital are needed.

To join a clinical trial, you must meet the conditions of the study. Patients in a clinical trial often have a similar cancer type and general health. This is to know that any progress is because of the treatment and not because of differences between patients.

To join, you'll need to review and sign a paper called 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 are getting treatment or at other treatment centers nearby. You can also find clinical trials through the websites listed in Part 5.



Complementary and alternative medicine

CAM (**complementary and alternative medicine**) is a group of treatments sometimes used by people with cancer. Many CAMs are being studied to see if they are truly helpful.

- Complementary medicines are meant to be used alongside standard therapies, most often for relaxation, improving your health, or to prevent or reduce side effects.
- Alternative medicine is treatment or techniques that are used instead of standard treatments, such as chemotherapy or radiation. Some are sold as cures even though they haven't been proven to work in clinical trials.

Many cancer centers or local hospitals have complementary therapy programs that offer acupuncture, yoga, and other types of therapy.

It's important to tell your treatment team if you are using any complementary medicines, especially supplements, vitamins, or herbs. Some of these can interfere with your cancer treatment. For example, some supplements or herbs can increase or decrease levels of chemotherapy or targeted therapy drugs in your body. This may cause more side effects or make the treatment not work as well. For more information about CAM, ask your doctor and visit the websites listed in Part 5.

Review

- ▶ Surgery and radiation therapy are used when there is a single mass of myeloma cells—called a solitary plasmacytoma.
- ▶ Chemotherapy drugs kill fast-growing cells, including cancer cells and normal cells.
- ▶ Targeted therapy drugs target a specific or unique feature of cancer cells.
- ▶ A stem cell transplant replaces damaged or diseased cells in the bone marrow with healthy blood stem cells.
- ▶ An autologous stem cell transplant uses your own blood stem cells.
- ▶ An allogeneic stem cell transplant uses blood stem cells from another person, called a donor.
- ▶ Adjunctive treatment for the symptoms of myeloma and side effects of myeloma treatment is very important.
- ▶ A clinical trial studies a test or treatment to see how safe it is and how well it works.

4

Treatment guide

39 Treatment options

40 Solitary plasmacytoma

42 Smoldering (asymptomatic)
multiple myeloma

43 Active (symptomatic) multiple
myeloma



This chapter is a guide through the treatment options for people with multiple myeloma. This information is based on treatment guidelines written by NCCN experts in multiple myeloma. These treatment guidelines list options for people with myeloma in general. Your doctors may suggest other treatment for you based on your health and personal wishes. Fully discuss your treatment options with your doctor.

There are many treatment options for myeloma. The type of treatment, and when it should start, depends on a number of factors. But, supportive care—adjunctive treatment—is an important part of the overall treatment for all patients.

Treatment options

The treatment options in this chapter are grouped by the extent of the cancer and severity of its symptoms. A solitary plasmacytoma is when there is only one mass of myeloma cells. Multiple myeloma is when myeloma cells are found in many sites throughout the bone marrow.

Multiple myeloma is divided into two main groups. The number of abnormal plasma cells (myeloma cells) in the bone marrow is a key factor used to define these groups. Other factors are also important.

Smoldering (asymptomatic) myeloma is defined as having:

- Presence of M-protein in the blood
- or
- An increased level of light chains (Bence Jones protein) in the urine
- and/or
- 10% to 59% abnormal plasma cells in the bone marrow (when 10 to 59 out of every 100 cells in the bone marrow are plasma cells)
- and
- No other myeloma symptoms such as kidney damage, bone damage, anemia, or increased levels of calcium in the blood or features of active myeloma as shown below

Active (symptomatic) myeloma is defined as having:

- At least 10% abnormal plasma cells in the bone marrow or a plasmacytoma confirmed by biopsy
- and
- One or more of the following myeloma-defining events:
 - At least 60% abnormal plasma cells in the bone marrow—60 or more cells out of every 100 cells in the bone marrow are plasma cells
 - An increased level of calcium in the blood
 - Kidney damage
 - A low number of red blood cells (anemia)
 - Presence of lytic bone lesions or 2 or more lesions in the bone marrow
 - A serum free light chain ratio of ≥ 100

Solitary plasmacytoma

Guide 3. Primary treatment and follow-up for solitary plasmacytoma

Cancer type	Primary treatment	Follow-up tests
Solitary osseous plasmacytoma	Radiation therapy ± surgery	Testing every 3 to 6 months with: <ul style="list-style-type: none"> • CBC with differential and platelet count • Blood chemistry tests: creatinine, albumin, corrected calcium • 24-hour urine for monoclonal protein • UPEP and UIFE as needed • Serum quantitative immunoglobulins, SPEP, and SIFE as needed • Serum FLC assay as needed • Serum LDH and beta-2 microglobulin as needed • Bone marrow aspirate and biopsy as needed • Bone survey as needed or every year • Whole-body MRI, low-dose CT, or whole-body FDG PET/CT scan as needed
Solitary extraosseous plasmacytoma	Radiation therapy ± surgery	

Guide 3 shows the primary treatment options for a solitary plasmacytoma. A solitary plasmacytoma is when there is only one mass of myeloma cells. Patients with multiple myeloma can also have plasmacytomas. Guide 3 is specifically for people who have a solitary plasmacytoma and do not have multiple myeloma. This guide also shows the follow-up tests you should receive after treatment.

Primary treatment is the main treatment used to rid the body of cancer. Treatment options are based on where the solitary plasmacytoma is located in the body. An osseous solitary plasmacytoma

begins in bone marrow. An extraosseous solitary plasmacytoma begins in soft tissue outside the bone.

Primary treatment

Because there is only one cancer mass in a solitary plasmacytoma, treatment includes local therapies. Local therapy is given to treat a specific area in the body. For a solitary plasmacytoma, local therapy includes radiation therapy and surgery. Radiation therapy may be given with or without surgery as primary treatment. (See Part 3 on page 24 for more details about each treatment.)

Follow-up tests

After you finish primary treatment, you should have follow-up tests every 3 to 6 months. People with soft tissue and head and neck plasmacytoma may be followed less often after the first follow-up visit.

The follow-up tests are used to check how well treatment worked. An outcome or improvement caused by treatment is called a *treatment response*. See page 46 to read about the types of treatment responses.

Most of the follow-up tests given after treatment are the same as those used to confirm myeloma and assess symptoms. Ongoing, frequent tests to measure M-protein levels are used to check the status of the cancer to make sure treatment is still working. (See Part 2 on page 14 for more details on each test listed in the guide.)

If follow-up tests show that the plasmacytoma has come back after primary treatment, local therapy may be an option depending on the location and size of the mass. If the cancer has spread, see Guide 1 on page 16 for recommended testing to assess the severity of multiple myeloma and its symptoms.

Next steps

- If tests show the cancer has spread, the next treatment options depend on the severity of myeloma and its symptoms. For smoldering (asymptomatic) myeloma, see Guide 4 on page 42.
- For active (symptomatic) myeloma, see Guide 5 on page 43.

Smoldering (asymptomatic) multiple myeloma

Guide 4. Primary treatment and follow-up for smoldering (asymptomatic) myeloma treatment

Cancer type	Primary treatment options	Follow-up tests
Smoldering (asymptomatic) multiple myeloma	<ul style="list-style-type: none"> Observe every 3 to 6 months Clinical trial 	<ul style="list-style-type: none"> CBC with differential and platelet count Blood chemistry tests: creatinine and corrected calcium 24-hour urine for total protein, UPEP, and UIFE Serum quantitative immunoglobulins, SPEP, and SIFE Serum FLC assay as needed Bone survey or whole-body low-dose CT scan as needed Bone marrow aspirate and biopsy with FISH and multi-parameter flow cytometry as needed Whole-body or skeletal MRI or whole-body FDG PET/CT scan as needed

Guide 4 shows the primary treatment options for multiple myeloma that isn't causing symptoms (smoldering myeloma) and follow-up tests. Myeloma that isn't causing symptoms is called smoldering (asymptomatic) multiple myeloma. Primary treatment is the initial treatment given to try to rid the body of cancer.

Smoldering myeloma often takes months or years to progress to active (symptomatic) myeloma. For this reason, treatment isn't needed right away. Observation is an option for some patients. Joining a clinical trial is strongly recommended if one is open and is the right fit for you.

Observation means that your doctor will watch for cancer growth with regular follow-up tests. Many of the tests used for follow-up are the same as those used to confirm myeloma and assess symptoms. During observation, you should have follow-up tests every 3 to 6 months to check the status of the cancer. (See Part 2 on page 14 for more details about each test.)

Next steps

If the cancer grows and starts causing symptoms, see Guide 5 on page 43 for treatment options for active (symptomatic) myeloma.

Active (symptomatic) multiple myeloma

Guide 5. Primary treatment and follow-up for active (symptomatic) myeloma

Cancer type	Primary treatment	Follow-up tests
Active (symptomatic) multiple myeloma	<ul style="list-style-type: none"> • Myeloma therapy (see primary treatment lists for transplant and non-transplant patients on page 44) • Bisphosphonates or denosumab • Supportive care treatment as needed 	<ul style="list-style-type: none"> • CBC with differential and platelet count • Blood chemistry tests: creatinine and corrected calcium • Serum quantitative immunoglobulins, SPEP, and SIFE as needed • 24-hour urine for total protein, UPEP, and UIFE as needed • Serum FLC assay as needed • Bone survey or whole-body low-dose CT scan as needed • Bone marrow aspirate and biopsy at relapse with FISH • Whole-body or skeletal MRI or whole-body FDG PET/CT scan as needed • Assess for stem cell transplant <ul style="list-style-type: none"> ◦ Refer to experts at stem cell transplant center ◦ Harvest stem cells (consider for 2 transplants)

Guide 5 shows the primary treatment options and follow-up tests for multiple myeloma that is causing symptoms. Myeloma that is causing symptoms is called *active myeloma* or *symptomatic myeloma*. Primary treatment is the first treatment given to try to rid your body of cancer.

Primary treatment for active myeloma includes systemic therapies. Systemic therapy travels in your body to treat more than one area of cancer. This type of treatment includes chemotherapy, targeted therapy, and steroids. These drugs may be given

alone or in combination. Follow-up tests are done to see if the treatment is working or if the disease is progressing (getting worse).

Treatment for active myeloma may or may not include a stem cell transplant. A stem cell transplant is not a good treatment option for everyone. Your doctor will look at a number of factors to decide if it might be the right choice for you. Some key factors include the health of your liver, kidneys, and heart. Your age and other current health problems are also important.

Primary treatment for transplant patients

Preferred options	Other options	Useful for some patients
<ul style="list-style-type: none"> Bortezomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/doxorubicin/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/dexamethasone
<ul style="list-style-type: none"> Bortezomib/cyclophosphamide/dexamethasone 	<ul style="list-style-type: none"> Carfilzomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/thalidomide/dexamethasone
	<ul style="list-style-type: none"> Ixazomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Cyclophosphamide/lenalidomide/dexamethasone
		<ul style="list-style-type: none"> Lenalidomide/dexamethasone
		<ul style="list-style-type: none"> Dexamethasone/thalidomide/cisplatin/doxorubicin/cyclophosphamide/etoposide/bortezomib

Primary treatment for non-transplant patients

Preferred options	Other options	Useful for some patients
<ul style="list-style-type: none"> Bortezomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Carfilzomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/dexamethasone
<ul style="list-style-type: none"> Lenalidomide/low-dose dexamethasone 	<ul style="list-style-type: none"> Carfilzomib/cyclophosphamide/dexamethasone 	
<ul style="list-style-type: none"> Bortezomib/cyclophosphamide/dexamethasone 	<ul style="list-style-type: none"> Ixazomib/lenalidomide/dexamethasone 	
<ul style="list-style-type: none"> Daratumumab/bortezomib/melphalan/prednisone 		

Primary treatment

Your primary treatment options depend on whether or not a stem cell transplant might be part of the overall treatment. Some drugs can cause severe damage to healthy cells in your bone marrow. This can make it more difficult to harvest stem cells for a transplant. Thus, some drugs are not recommended for primary treatment if you might have a stem cell transplant later. If your doctor thinks you might have a stem cell transplant, he or she would harvest stem cells after 3 to 6 cycles of treatment. The goal is to harvest enough for 2 possible transplants.

For active myeloma, the primary treatment options are also split into 3 groups—preferred regimens, other regimens, and those used for some patients.

Compared to “other” regimens, “preferred” regimens have been proven to work better and/or have less severe side effects. The regimens in the “other options” or “useful in some patients” categories have not yet undergone sufficient testing or have been proven to be less effective than the “preferred” regimens. (See Part 3 on page 24 for more details about each type of myeloma treatment.) Ask your

doctor to explain which primary treatment options may be available to you.

Adjunctive treatment

Along with primary treatment for myeloma, you will also receive adjunctive treatment. It is given to “assist” the primary treatment, such as by improving its safety or how well it works. For myeloma, adjunctive treatment includes supportive care to manage the symptoms of myeloma and side effects of myeloma treatment.

Recommended adjunctive treatments can include:

- ▶ Bisphosphonates or denosumab for bone health (recommended for all patients)
- ▶ Drugs, radiation therapy, or surgery for bone pain
- ▶ Drug treatment for high calcium levels
- ▶ Plasmapheresis for hyperviscosity
- ▶ Erythropoietin for anemia
- ▶ Vaccines and treatments for infections
- ▶ Blood thinners to prevent blood clots
- ▶ Liquids and possible plasmapheresis to reverse kidney damage

Adjunctive treatments are recommended based on the symptoms and side effects you have. So, you may not need every adjunctive treatment listed. Bone damage from myeloma is very common. Therefore, bisphosphonates or denosumab are recommended. Denosumab is a better choice than bisphosphonates for people whose kidneys don't work well.

Drugs such as thalidomide, lenalidomide, and pomalidomide can cause serious blood clots. If these drugs are part of the primary treatment given, then blood thinners may be recommended. Blood thinners

are medicines that thin out blood to treat or lower the risk of blood clots.

Other adjunctive treatments may be given as symptoms of myeloma or side effects of myeloma treatment appear. For more details about each adjunctive treatment, read page 33 in Part 3.

Follow-up tests

Follow-up tests are used to check for a treatment response. Many of the tests used for follow-up will be the same as those used to confirm (diagnose) myeloma. A bone marrow aspiration and biopsy may be done to check if plasma cell levels in the bone marrow have decreased. A CBC will show if the number of blood cells is low for each blood cell type.

Blood chemistry tests check if certain substances in your blood are too low or too high. Tests of BUN, creatinine, and calcium levels help check for symptoms of myeloma such as kidney damage and bone damage. The other blood tests and urine tests assess if M-protein levels are falling. (See Part 2 on page 14 for more details about each test.)

Next steps

After primary treatment, see Guide 6 on page 47 for your next treatment options based on the results of the follow-up tests in Guide 5.

Measuring treatment responses

A treatment response is an outcome or improvement caused by treatment. The response is defined by how well treatment is killing myeloma cells and improving the severity of symptoms. The main types of treatment responses are listed below. “Complete” and “partial” responses are often jointly referred to as “response.”

Complete response

No M-proteins are found in the blood or urine. Less than 5 out of 100 cells in the bone marrow are plasma cells.

Partial response

The amount of M-proteins in the blood has decreased by at least 50%. The amount of M-proteins in the urine has decreased by at least 90%. Also, there is no increase in the size or number of bone lesions.

Stable disease

Tests do not show a complete or partial response as defined above or progressive disease as defined below. Also, there is no increase in the size or number of bone lesions.

Progressive disease

One or more of the following has occurred: at least a 25% increase in the amount of M-proteins in the blood or urine, a 25% increase in the number of plasma cells in the bone marrow, an increase in the size or number of bone lesions, or an increase in calcium levels not explained by other conditions.

Clinical relapse

One or more of the following has occurred: there are direct signs of cancer growth, signs of organ damage, an increase in the number or size (at least 50% larger) of plasmacytomas or bone lesions, increased calcium levels, an increase in creatinine levels in blood, or a decrease in the number of red blood cells.

Relapse from complete response

One or more of the following has occurred in a patient who had a complete response: a return of M-proteins in blood or urine, or other signs of myeloma but not meeting the criteria for a clinical relapse or progressive disease shown above.

Guide 6. Next treatment options and follow-up tests

Test results		Next treatment options		Next steps
Treatment response	→	<ul style="list-style-type: none"> Autologous stem cell transplant Allogeneic stem cell transplant Stay on myeloma therapy (until best response) or maintenance therapy 	→	<p>Follow-up tests</p> <ul style="list-style-type: none"> CBC with differential and platelet count Blood chemistry tests: creatinine and corrected calcium Serum quantitative immunoglobulins, SPEP, and SIFE 24-hour urine for total protein, UPEP, and UIFE Serum FLC assay as needed Bone survey or whole-body low-dose CT scan as needed Bone marrow aspirate and biopsy as needed Whole-body or skeletal MRI or whole-body FDG PET/CT scan as needed Assess for MRD (minimal residual disease) as needed
No treatment response	→	<p>Treatment for relapse or progressive disease:</p> <ul style="list-style-type: none"> Therapy for previously treated myeloma (see list on page 49) Clinical trial Autologous stem cell transplant Allogeneic stem cell transplant 	→	Palliative care

Guide 6 shows the next treatment options after primary treatment. Follow-up tests are used to check how well primary treatment is working. An outcome or improvement caused by treatment is called a *treatment response*. Your next treatment options are based on results of the follow-up tests.

Test results and next treatment options

The next treatment options are based on how the myeloma responded to primary treatment.

If tests show a treatment response, then you have three options to choose from next. The first two options are only for patients who are able to have a stem cell transplant. This treatment destroys cells in the bone marrow with chemotherapy and then replaces them with healthy blood stem cells. An autologous stem cell transplant uses your own stem cells. An allogeneic stem cell transplant uses blood stem cells from another person, called a donor.

For an autologous stem cell transplant, your stem cells will be harvested after primary treatment when the number of myeloma cells is low. Enough stem cells should be collected for two transplants depending on your age. This is needed since you may have a tandem stem cell transplant or a second transplant as later treatment. (See page 29 for more details about stem cell transplants.)

After the allogeneic or autologous stem cell transplant, the follow-up tests listed in Guide 5 will be repeated to check for a treatment response. Tests to check the level of M-proteins in your blood and urine should be done at least every 3 months.

If you aren't able to have a stem cell transplant, or you don't want a transplant right away, then there is a third option to choose from. The third option, for all patients, is to stay on primary treatment until no further treatment response is seen with follow-up tests. Your doctor will monitor the cancer with the follow-up tests listed in Guide 5 on page 43.

Along with follow-up tests you will also be offered maintenance therapy after the autologous stem cell transplant. Maintenance therapy is medicine given in a lower dose or less often to keep (maintain) the good results of prior treatments. It is helpful to discuss the benefits and risks of taking maintenance therapy with your doctor. Recommended maintenance therapy options for myeloma following autologous stem cell transplant are listed next.

Maintenance therapy

Preferred options	Other options
Lenalidomide	Bortezomib

If tests do not show a treatment response, then you will receive treatment for myeloma that came back (relapsed) or continued to grow (progressed) during prior treatment. See the list of treatment options listed on the next page. These options are for people who have already received a drug treatment for myeloma. A number of drugs in the list have shown that long responses can occur in the advanced disease setting.

For myeloma that has relapsed or is progressing (previously treated), the primary treatment options are also split into 3 groups—preferred regimens, other regimens, and those that are useful for some patients. Compared to “other” regimens, “preferred” regimens have thus far been proven to work better, have less severe side effects, or both. Some of the regimens listed in the “Other options” category have not yet gone through all phases of clinical trial testing.

Myeloma therapy for previously treated multiple myeloma

Preferred options	Other options		Useful for some patients
<ul style="list-style-type: none"> Bortezomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bendamustine/bortezomib/dexamethasone 	<ul style="list-style-type: none"> Ixazomib/dexamethasone 	<ul style="list-style-type: none"> Bendamustine
<ul style="list-style-type: none"> Carfilzomib (twice weekly)/dexamethasone 	<ul style="list-style-type: none"> Bendamustine/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Ixazomib/pomalidomide/dexamethasone 	<ul style="list-style-type: none"> Dexamethasone/cyclophosphamide/etoposide/bortezomib
<ul style="list-style-type: none"> Carfilzomib (weekly)/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/liposomal doxorubicin/dexamethasone 	<ul style="list-style-type: none"> Lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Dexamethasone/thalidomide/cisplatin/doxorubicin/cyclophosphamide/etoposide ± bortezomib
<ul style="list-style-type: none"> Carfilzomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/cyclophosphamide/dexamethasone 	<ul style="list-style-type: none"> Panobinostat/bortezomib/dexamethasone 	<ul style="list-style-type: none"> High-dose cyclophosphamide
<ul style="list-style-type: none"> Daratumumab/bortezomib/dexamethasone 	<ul style="list-style-type: none"> Carfilzomib/cyclophosphamide/dexamethasone 	<ul style="list-style-type: none"> Panobinostat/Carfilzomib 	
<ul style="list-style-type: none"> Daratumumab/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Cyclophosphamide/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Panobinostat/lenalidomide/dexamethasone 	
<ul style="list-style-type: none"> Elotuzumab/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Bortezomib/dexamethasone 	<ul style="list-style-type: none"> Pomalidomide/cyclophosphamide/dexamethasone 	
<ul style="list-style-type: none"> Ixazomib/lenalidomide/dexamethasone 	<ul style="list-style-type: none"> Daratumumab 	<ul style="list-style-type: none"> Pomalidomide/dexamethasone 	
	<ul style="list-style-type: none"> Daratumumab/pomalidomide/dexamethasone 	<ul style="list-style-type: none"> Pomalidomide/bortezomib/dexamethasone 	
	<ul style="list-style-type: none"> Elotuzumab/bortezomib/dexamethasone 	<ul style="list-style-type: none"> Pomalidomide/carfilzomib/dexamethasone 	
	<ul style="list-style-type: none"> Elotuzumab/pomalidomide/dexamethasone 		

Guide 7. Treatment after allogeneic stem cell transplant

Test results		Next treatment options		Next options for progressive disease
Treatment response or stable disease	→	<ul style="list-style-type: none"> • Maintenance therapy as part of a clinical trial • Observe 	→	<ul style="list-style-type: none"> • Therapy for previously treated myeloma • Clinical trial • Donor lymphocyte infusion
Progressive disease		→		

Guide 7 shows the treatment options that may be used after an allogeneic stem cell transplant. An allogeneic transplant is a treatment in which you receive healthy blood stem cells from another person. The next treatment options depend on how the myeloma responded to the stem cell transplant. A treatment response is an outcome or improvement caused by treatment. See page 46 to read about the types of treatment responses.

If tests show a treatment response or stable disease, then you have two treatment options to choose from. One option is to receive maintenance therapy as part of a clinical trial. Maintenance therapy is medicine given in a lower dose or less often to keep (maintain) the good results of prior treatments.

The second option is to begin observation—a period of testing to watch for cancer growth. If myeloma returns or gets worse after either of these options, then you will have treatment for progressive disease as described below.

If tests show progressive disease, then you have a few treatment options to choose from. The first option is to receive additional treatment, possibly within a clinical trial. Additional treatment is given after prior treatments are not working and the cancer remains or continues to grow.

A doctor may also recommend you receive a donor lymphocyte infusion. A donor lymphocyte infusion is when you are given white blood cells called lymphocytes from the same donor used for the allogeneic stem cell transplant.

Guide 8. Treatment after autologous stem cell transplant

Test results		Next treatment options		Next options for progressive disease
Treatment response or stable disease	→	<ul style="list-style-type: none"> Maintenance therapy Clinical trial 	→	<ul style="list-style-type: none"> Therapy for previously treated myeloma Clinical trial ± additional autologous stem cell transplant Allogeneic stem cell transplant
Progressive disease		→		<ul style="list-style-type: none"> Therapy for previously treated myeloma Clinical trial Allogeneic stem cell transplant

Guide 8 shows the treatment options that may be used after an autologous stem cell transplant. An autologous stem cell transplant is a treatment in which your own blood stem cells are removed, stored, and then returned. The next treatment options depend on how the myeloma responded to the transplant. A treatment response is an outcome or improvement caused by treatment. See page 46 to read about the types of treatment responses.

If tests show a treatment response or stable disease, you have two treatment options to choose from. The first option is to receive maintenance therapy. Maintenance therapy is medicine given in a lower dose or less often to keep (maintain) good results of prior treatments. Another option is to receive treatment in a clinical trial.

If tests show progressive disease after any of the treatments described above, you have a few more treatment options to choose from. The first option is to receive additional treatment. Additional treatment is given after prior treatments are not working and the cancer remains or continues to grow. Another option is to receive treatment in a clinical trial with or without another autologous stem cell transplant.

A treatment response lasting at least 2 to 3 years prior to progression is suggested for consideration of another autologous stem cell transplant. If this is not an option, your doctor may also consider an allogeneic stem cell transplant.

If tests show progressive disease, then you have a few treatment options to choose from. One option is to receive additional treatment. Another option is to receive treatment in a clinical trial. The other option is to receive an allogeneic stem cell transplant.

If tests show progressive disease during or after additional treatment, then palliative care may be recommended. Palliative care is given to relieve symptoms of cancer and side effects of cancer treatment. It doesn't aim to treat the cancer, but aims to improve quality of life.

5

Making treatment decisions

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Having cancer can be very stressful. While absorbing the fact that you have cancer, you must also learn about tests and treatments. And, the time you have to decide on a treatment plan may feel short. Parts 1 through 4 described the test and treatment options recommended by NCCN experts. These options are based on science and agreement among NCCN experts. This chapter aims to help you make decisions that are in line with your beliefs, wishes, and values. It may be helpful to have other family members or loved ones help you make these important decisions.

It's your choice

The role patients want in choosing their 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. However, 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 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, your treatment team may still ask that you sign a consent form.

On the other hand, you may want to take the lead or share in decision-making. In shared decision-making, you and your doctors share information, discuss 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 can decide on a plan that works best for you when it comes to your personal and health needs.

Questions to ask your doctors

You will likely meet with experts from different fields of medicine. It is helpful to talk with each person. Prepare questions before your visit and ask questions if the information isn't clear. You can get copies of your medical records. It may be helpful to have a family member or friend with you at these visits to listen carefully and even take notes. A patient advocate or navigator might also be able to come. They can help you ask questions and remember what was said.

The questions on the following pages are suggestions for information you read about in this book. Feel free to use these questions or come up with your own personal questions to ask your doctor and other members of your treatment team.

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?
2. Is this cancer common?
3. What is the cancer stage? Does this stage mean the cancer has spread far?
4. Is this a fast- or slow-growing type of myeloma? What are the specific lab reports and test results that indicate this?
5. What other tests results are important to know?
6. How often are these tests wrong?
7. Would you give me a copy of the pathology report and other test results?
8. Can the cancer be cured? If not, how well can treatment stop the cancer from growing?

What are my options?

There is no single treatment practice that is best for all patients. 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?
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? 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. What can be done to prevent or relieve the side effects of treatment?
12. How quickly must I make these treatment decisions?

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. Do I have a choice of when to begin treatment? Can I choose the days and times of treatment?
3. How do I prepare for treatment? Do I have to stop taking any of my medicines? Are there foods I will have to avoid?
4. Should I bring someone with me when I get treated?
5. Will the treatment hurt?
6. How much will the treatment cost me? What does my insurance cover?
7. Will I miss work or school? Will I be able to drive?
8. Is home care after treatment needed? If yes, what type?
9. How soon will I be able to manage my own health?
10. 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, so science isn't helpful. Some ways to decide on treatment are discussed next.

Getting a 2nd opinion

Even if you like and trust your doctor, it is helpful to get a 2nd opinion. You will want to have another doctor review your test results. He or she can suggest a treatment plan or check the one you already heard about.

Things you can do to prepare:

- ▶ Check with your insurance company about its rules on 2nd opinions. You want to know about out-of-pocket costs for doctors who are not part of your insurance plan.
- ▶ Make plans to have copies of all your records sent to the doctor you will see for your 2nd opinion. Do this well before your appointment. If you run into trouble having records sent, pick them up and bring them with you.

If the new doctor offers other advice, make an appointment with your first doctor to talk about the differences. Do whatever you need to feel confident about your diagnosis and treatment plan.

Getting support

Support groups often include people at different stages of treatment. Some may be in the process of deciding while others may be finished with treatment. At support groups, you can ask questions and hear about the experiences of other people with multiple myeloma. If your hospital or community doesn't have support groups for people with multiple myeloma, check out the websites on the next page.

You can also reach out to a social worker or psychologist. They can help you find ways to cope or refer you to support services. These services may also be available to your family, friends, and those with children so they can connect and get support.

Keep in mind...

- ✓ Every treatment option has benefits and risks. Consider these when deciding which option is best for you.
- ✓ Talking to others may help identify benefits and risks you haven't thought of.

Websites

American Cancer Society

cancer.org/cancer/multiplemyeloma/index

cancer.org/Treatment/FindingandPayingforTreatment/index

Blood & Marrow Transplant Information Network (BMT InfoNet)

bmtinfonet.org

International Myeloma Foundation

myeloma.org

The Leukemia & Lymphoma Society (LLS)

lls.org/disease-information/myeloma

Multiple Myeloma Research Foundation (MMRF)

themmrf.org

National Bone Marrow Transplant Link (nbmtLINK)

nbmtlink.org

National Cancer Institute

cancer.gov/types/myeloma

National Coalition for Cancer Survivorship

canceradvocacy.org/toolbox

NCCN

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.

Words to know

active (symptomatic) myeloma

When abnormal plasma cells (myeloma cells) have increased in the bone marrow and are causing symptoms such as kidney problems and bone damage.

adjunctive treatment

Medicine for symptoms of myeloma and side effects of myeloma treatment that is given at the same time as the main cancer treatment.

albumin

The main protein in blood plasma (yellowish part of blood).

allogeneic stem cell transplant

A treatment that destroys cells in the bone marrow with chemotherapy and then replaces them with healthy blood stem cells from another person.

amyloid

An abnormal protein that is formed by clumps of abnormal light chains and can damage organs.

amyloidosis

A health condition in which a protein called amyloid builds up in and damages organs.

anemia

A health condition in which the number of red blood cells is low.

anesthesia

Loss of feeling with or without loss of wakefulness caused by drugs.

antibody

A protein that is made by plasma cells, a type of white blood cell, to help fight off infections. Also called immunoglobulin.

apheresis

A procedure in which stem cells are removed from blood.

asymptomatic

Having no signs or symptoms of disease.

autologous stem cell transplant

A treatment that destroys cells in the bone marrow with chemotherapy and then replaces them with your own healthy blood stem cells.

B-cell

A type of white blood cell that turns into a plasma cell in response to germs.

Bence Jones myeloma

Condition in which myeloma cells make only free light chains and no complete M-proteins. Also called light chain myeloma.

Bence Jones protein

The shorter protein chain that is part of an M-protein. Also called a light chain.

beta-2 microglobulin

A small protein made by many cells, including white blood cells and myeloma cells.

biopsy

Removal of small amounts of tissue from the body to be tested for disease.

bisphosphonates

Drugs that help improve bone strength and prevent loss of bone mass.

blood chemistry test

A test that measures the amount of certain substances in the blood to check for signs of disease.

blood clot

A mass of blood that forms when blood platelets, proteins, and cells stick together.

blood stem cell

An immature cell from which all other types of blood cells are made.

bloodstream

Blood that flows throughout the body in small tubes called blood vessels.

blood thinner

A drug that thins out the blood to treat or reduce the risk of blood clots.

blood urea nitrogen (BUN)

A waste product made by the liver and filtered out of blood into urine by the kidneys.

bone densitometry

A test that uses x-rays to make pictures that show how strong or thin bones are.

bone lesion

An area of bone damage or abnormal tissue in the bone.

bone marrow

The soft, sponge-like tissue in the center of most bones where blood cells are made.

bone marrow aspiration

The removal of a small amount of liquid bone marrow (soft tissue in the center of bones where blood cells are made) to test for disease.

bone marrow biopsy

The removal of a small amount of solid bone and bone marrow (soft tissue in the center of bones where blood cells are made) to test for disease.

bone survey

A set of x-rays of the entire skeleton to look for broken or damaged bones. Also called skeletal survey.

BUN

blood urea nitrogen

calcium

A mineral needed for healthy teeth, bones, and other body tissues.

CAM

complementary and alternative medicine

CBC

complete blood count

chemotherapy

Drugs that kill fast-growing cells throughout the body, including normal cells and cancer cells.

chromosomes

Long strands that contain bundles of coded instructions in cells for making and controlling cells.

clinical trial

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

clone

An exact copy.

complete blood count (CBC)

A test of the number of blood cells.

compression fracture

A break (fracture) in a bone caused by the collapse of bones in the spine.

computed tomography (CT) scan

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.

core needle biopsy

Use of a wide, hollow needle to remove a large sample of tissue from the body to test for cancer cells.

creatinine

A waste product of muscles that is filtered out of blood into urine by the kidneys.

CT

computed tomography

cycle

Days of treatment followed by days of rest.

diagnose

To confirm or identify a disease or health condition.

differential

A test of the number of blood cells, including the different types of white blood cells (neutrophils, lymphocytes, monocytes, basophils, and eosinophils). The amount of hemoglobin (substance in the blood that carries oxygen) and the hematocrit (the amount of whole blood that is made up of red blood cells) are also measured.

donor

A person who gives blood, cells, tissue, or an organ to another person.

donor lymphocyte infusion

Treatment in which the patient receives white blood cells called lymphocytes from the same donor used for the allogeneic stem cell transplant.

EBRT

external beam radiation therapy

electrolytes

Minerals in blood that carry an electric charge and control some body functions.

erythropoietin

A drug used to treat patients with low red blood cell counts.

external beam radiation therapy (EBRT)

Radiation therapy (use of high-energy rays to destroy cancer cells) received from a machine outside the body.

extraosseous

Occurring outside the bone.

fatigue

Severe tiredness despite getting enough sleep.

fat pad

The fat that is just under the skin of the belly area.

FDA

U.S. Food and Drug Administration

FDG

fluorodeoxyglucose

fine-needle aspiration (FNA) biopsy

Use of a thin needle to remove a small amount of tissue from the body to test for cancer cells.

FISH

fluorescence in situ hybridization

FLC

free light chain

flow cytometry

A test that measures myeloma cells in the bone marrow (soft tissue in the center of bones where blood cells are made).

fluorescence in situ hybridization (FISH)

A lab test that uses special dyes to look for abnormal changes in a cell's genes (coded instructions for controlling cells) and chromosomes (long strands of genes).

fluorodeoxyglucose

A mix of fluoride and glucose that is used to find cancer on certain imaging tests.

FNA

fine-needle aspiration

follow-up test

Tests done after the start of treatment to check how well treatment is working.

fracture

A crack or break in a bone.

free light chain

The unattached, shorter fragments of M-proteins that are made by myeloma cells.

gene

A set of coded instructions in cells needed to make new cells and control how cells behave.

gene mutation

Abnormal change in the instructions in cells for making and controlling cells.

general anesthesia

A controlled loss of wakefulness from drugs.

genetic tests

Tests of the instructions in cells for making and controlling cells.

graft-versus-host disease (GVHD)

A disease that occurs when transplanted blood stem cells from another person (donor) attack a patient's normal cells.

graft-versus-tumor (GVT) effect

An attack on cancer cells by transplanted blood stem cells from another person (donor).

GVHD

graft-versus-host disease

GVT

graft-versus-tumor

harvest

The process of removing blood stem cells from a person.

heavy chain

The longer protein chain that is part of an antibody (protein that helps the body fight off infections).

HDAC

histone deacetylase

high-dose chemotherapy

An intensive drug treatment to kill cancer and disease-fighting cells so transplanted blood stem cells aren't rejected by the body.

HLA

human leukocyte antigen

human leukocyte antigen (HLA)

Special proteins on the surface of cells that help the body to tell its own cells apart from foreign cells.

human leukocyte antigen (HLA) type

The unique set of proteins on the surface of cells that help the body to tell its own cells apart from foreign cells.

human leukocyte antigen (HLA) typing

A blood test that finds a person's HLA type—the unique set of proteins on the surface of cells that help the body to tell its own cells apart from foreign cells.

hyperviscosity

A condition in which the blood becomes very thick because of too many proteins in the blood.

imaging test

A test that makes pictures (images) of the inside of the body.

immune system

The body's natural defense against infection and disease.

immunoglobulin

A protein that is made by plasma cells to help fight off infection. Also called antibody.

inflammation

Redness, heat, pain, and swelling from injury or infection.

intestine

The organ that food passes through after leaving the stomach.

intravenous

Given by a needle or tube inserted into a vein.

IV

intravenous

kidneys

A pair of organs that filter blood and remove waste from the body through urine.

kyphoplasty

Surgery to support the spine with a balloon-like device and a type of cement.

lactate dehydrogenase (LDH)

A protein found in the blood that is involved in energy production in cells.

LDH

lactate dehydrogenase

light chain

The shorter protein chain that is part of an antibody.

light chain myeloma

Condition in which myeloma cells make only free light chains and no complete M-proteins. Also called Bence Jones myeloma.

liver

Organ that removes waste from the blood.

local anesthesia

A controlled loss of feeling in a small area of the body caused by drugs.

local therapy

Treatment that affects cells in one specific area of the body only.

lymphocyte

A type of white blood cell that helps to protect the body from infection.

lytic bone lesion

An area of bone that looks as if it has been eaten away.

magnetic resonance imaging (MRI) scan

A test that uses radio waves and powerful magnets to view parts of the inside of the body and how they are working.

maintenance treatment

Medicine that is given in a lower dose or less often to keep (maintain) good results of prior treatments.

medical history

All health events and medications taken to date.

MGUS

monoclonal gammopathy of undetermined significance

microscope

A tool that uses lenses to see very small things the eyes can't.

mini transplant

A cancer treatment that uses low doses of chemotherapy before giving the patient healthy, immature blood-forming cells (blood stem cells) taken from another person called a donor.

M-protein

An abnormal antibody made by myeloma cells that doesn't fight germs. Also called monoclonal protein.

MRD

minimal residual disease

MRI

magnetic resonance imaging

multiple myeloma

A cancer of plasma cells—white blood cells that make germ-fighting proteins—that has spread throughout the bone marrow.

myeloma cell / myeloma cancer cell

An abnormal plasma cell that makes too many copies of itself and that grows and divides all the time.

NSAID

nonsteroidal anti-inflammatory drug

observation

A period of testing without treatment or right after treatment to check for cancer growth.

oligosecretory myeloma

Myeloma that makes very few or no M-proteins. Also called nonsecretory myeloma.

orthopedic surgeon

A surgeon who's an expert in operations of the bones.

osseous

Occurring inside the bone.

osteonecrosis

The death of bone cells.

pathologist

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

PET

positron emission tomography

PET/CT

positron emission tomography/computed tomography

physical exam

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

plasma

The yellowish liquid part of blood that carries blood cells.

plasma cell

A type of white blood cell that makes germ-fighting proteins.

plasma cell proliferation

A test that shows how many myeloma cells are dividing.

plasmacytoma

A mass formed by abnormal plasma cells (myeloma cells).

plasmapheresis

A process that removes excess proteins, such as M-proteins, from the blood.

platelet

A type of blood cell that forms blood clots to control bleeding.

pneumonia

A severe inflammation of the lungs.

positron emission tomography/computed tomography (PET/CT) scan

A test that uses radioactive material and x-rays to see the shape and function of organs and tissues inside the body.

positron emission tomography (PET) scan

A test that uses radioactive material to see the shape and function of organs and tissues inside the body.

primary treatment

The main treatment used to rid the body of cancer.

prognosis

The likely or expected course and outcome of a disease.

progression

The course of disease as it gets worse or spreads in the body.

progressive disease

Cancer that is growing, spreading, or getting worse.

protein

A chain of small chemical compounds important to every cell.

radiation therapy

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

red blood cell

A type of blood cell that carries oxygen from the lungs to the rest of the body.

regimen

A treatment plan that specifies the dose, schedule, and duration of treatment.

relapse

The return of myeloma signs or symptoms after a period of improvement.

sedative

A drug that helps a person to relax or go to sleep.

serum free light chain assay

A blood test that measures the amount of the shorter fragments of the proteins made by myeloma cells.

serum immunofixation electrophoresis (SIFE)

A test used to identify the type of M-proteins in the blood.

serum protein electrophoresis (SPEP)

A test that measures the amount of M-proteins in the blood.

serum quantitative immunoglobulins

A test that measures the amount of each type of antibody in the blood.

serum viscosity

A test that measures the thickness of blood.

side effect

An unhealthy or unpleasant physical or emotional response to treatment.

SIFE

serum immunofixation electrophoresis

smoldering (asymptomatic) myeloma

Myeloma that isn't causing symptoms or damaging organs.

solitary plasmacytoma

Cancer that is one mass of myeloma cells—abnormal plasma cells that grow and divide all the time making too many copies of themselves.

SPEP

serum protein electrophoresis

spine

The bones, muscles, and other tissues along the back from the base of the skull to the tailbone.

stable disease

Cancer that is not getting worse or better in terms of extent or severity.

stem cell transplant

Treatment that uses chemotherapy to destroy cells in the bone marrow and then replaces them with healthy blood stem cells.

steroid

A drug used to reduce swelling, redness, and pain, but also to kill myeloma cells.

supportive care

Treatment for symptoms of cancer or side effects of cancer treatment.

surgeon

A doctor who's an expert in operations to remove or repair a part of the body.

surgery

An operation to remove or repair a part of the body.

symptom

A physical or mental problem a person experiences that may indicate a certain disease or health condition.

systemic therapy

Drugs used to treat cancer cells throughout the body.

tandem stem cell transplant

Treatment in which a planned second round of high-dose chemotherapy and autologous stem cell transplant are given within 6 months of the first transplant.

targeted therapy

Treatment with drugs that target a specific or unique feature of cancer cells.

tissue biopsy

Removal of a small amount of tissue from the body to test for disease.

total protein (urine)

A test that measures the amount and type of protein in urine collected over a 24-hour period.

transfusion

Replacing lost blood with new blood.

treatment response

An outcome or improvement caused by treatment.

tumor burden

The amount or extent of cancer in the body.

UIFE

urine immunofixation electrophoresis

UPEP

urine protein electrophoresis

U.S. Food and Drug Administration (FDA)

A federal government agency that regulates drugs and food.

urine immunofixation electrophoresis (UIFE)

A test that identifies the type of M-proteins in the urine.

urine protein electrophoresis (UPEP)

A test that shows the amount of M-proteins in the urine.

vaccine

A biological agent inserted into the body to prevent a disease.

vein

A small tube that carries blood to the heart from anywhere in the body.

vertebrae

The chain of 33 bones in the back that protect a vital group of nerves.

vertebroplasty

A procedure to strengthen bones in the spine with bone cement.

white blood cell

A type of blood cell that fights infection.

NCCN Contributors

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Dorothy A. Shead, MS
Director, Patient Information Operations

Erin Vidic, MA
Medical Writer

Kim Williams
Creative Services Manager

Laura J. Hanisch, PsyD
Medical Writer/Patient Information Specialist

Rachael Clarke
Senior Medical Copyeditor

Susan Kidney
Design Specialist

The NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Multiple Myeloma Version 2.2019 were developed by the following NCCN Panel Members:

* Shaji K. Kumar, MD/ Chair
Mayo Clinic Cancer Center

Kelly Godby, MD
University of Alabama at Birmingham Comprehensive Cancer Center

Thomas Martin, MD
UCSF Helen Diller Family Comprehensive Cancer Center

Natalie S. Callander, MD/Vice Chair
University of Wisconsin Carbone Cancer Center

Jens Hillengass, MD
Roswell Park Comprehensive Cancer Center

James L. Omel, MD
Patient Advocate

J. Sybil Biermann, MD
University of Michigan Rogel Cancer Center

Leona Holmberg, MD, PhD
Fred Hutchinson Cancer Research Center/Seattle Cancer Care Alliance

Noopur Raje, MD
Dana-Farber/Brigham and Women's Cancer Center Massachusetts General Hospital Cancer Center

Jorge J. Castillo, MD
Dana-Farber/Brigham and Women's Cancer Center Massachusetts General Hospital Cancer Center

Sarah Holstein, MD, PhD
Fred & Pamela Buffett Cancer Center University of Nebraska Medical Center

Seema Singhal, MD
Robert H. Lurie Comprehensive Cancer Center of Northwestern University

Jason C. Chandler, MD
St. Jude Children's Research Hospital/The University of Tennessee Health Science Center

Myo Htut, MD
City of Hope National Medical Center

Keith Stockerl-Goldstein, MD
Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine

Robert F. Cornell, MD
Vanderbilt-Ingram Cancer Center

Carol Ann Huff, MD
The Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins

Carlyn Tan, MD
Fox Chase Cancer Center

Caitlin Costello, MD
UC San Diego Moores Cancer Center

Yubin Kang, MD
Duke Cancer Institute

Donna M. Weber, MD
The University of Texas MD Anderson Cancer Center

Yvonne Efebera, MD, MPH
The Ohio State University Comprehensive Cancer Center - James Cancer Hospital and Solove Research Institute

Ola Landgren, MD
Memorial Sloan Kettering Cancer Center

NCCN Staff

Matthew Faiman, MD
Case Comprehensive Cancer Center/University Hospitals Seidman Cancer Center and Cleveland Clinic Taussig Cancer Institute

Michaela Liedtke, MD
Stanford Cancer Institute

Alyse Johnson-Chilla, MS
Guidelines Coordinator

Ehsan Malek, MD
Case Comprehensive Cancer Center/University Hospitals Seidman Cancer Center and Cleveland Clinic Taussig Cancer Institute

Rashmi Kumar, PhD
Director, Clinical Information Operations

* Reviewed the clinical content of this book.

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NCCN Cancer Centers

Abramson Cancer Center
at the University of Pennsylvania
Philadelphia, Pennsylvania
800.789.7366
pennmedicine.org/cancer

Fred & Pamela Buffett Cancer Center
Omaha, Nebraska
800.999.5465
unmc.edu/cancercenter

Case Comprehensive Cancer Center/
University Hospitals Seidman Cancer
Center and Cleveland Clinic Taussig
Cancer Institute
Cleveland, Ohio
800.641.2422 • UH Seidman Cancer Center
uhhospitals.org/seidman
866.223.8100 • CC Taussig Cancer Institute
my.clevelandclinic.org/services/cancer
216.844.8797 • Case CCC
case.edu/cancer

City of Hope
National Medical Center
Los Angeles, California
800.826.4673
cityofhope.org

Dana-Farber/Brigham and
Women's Cancer Center
Massachusetts General Hospital
Cancer Center
Boston, Massachusetts
877.332.4294
dfbwcc.org
massgeneral.org/cancer

Duke Cancer Institute
Durham, North Carolina
888.275.3853
dukecancerinstitute.org

Fox Chase Cancer Center
Philadelphia, Pennsylvania
888.369.2427
foxchase.org

Huntsman Cancer Institute
at the University of Utah
Salt Lake City, Utah
877.585.0303
huntsmancancer.org

Fred Hutchinson Cancer
Research Center/Seattle
Cancer Care Alliance
Seattle, Washington
206.288.7222 • seattlecca.org
206.667.5000 • fredhutch.org

The Sidney Kimmel Comprehensive
Cancer Center at Johns Hopkins
Baltimore, Maryland
410.955.8964
hopkinskimmelfcancercenter.org

Robert H. Lurie Comprehensive Cancer
Center of Northwestern University
Chicago, Illinois
866.587.4322
cancer.northwestern.edu

Mayo Clinic Cancer Center
Phoenix/Scottsdale, Arizona
Jacksonville, Florida
Rochester, Minnesota
800.446.2279 • Arizona
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
800.525.2225
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
877.275.7724
roswellpark.org

Siteman Cancer Center at Barnes-
Jewish Hospital and Washington
University School of Medicine
St. Louis, Missouri
800.600.3606
siteman.wustl.edu

St. Jude Children's Research Hospital
The University of Tennessee
Health Science Center
Memphis, Tennessee
888.226.4343 • stjude.org
901.683.0055 • westclinic.com

Stanford Cancer Institute
Stanford, California
877.668.7535
cancer.stanford.edu

University of Alabama at Birmingham
Comprehensive Cancer Center
Birmingham, Alabama
800.822.0933
www3.ccc.uab.edu

UC San Diego Moores Cancer Center
La Jolla, California
858.657.7000
cancer.ucsd.edu

UCSF Helen Diller Family
Comprehensive Cancer Center
San Francisco, California
800.689.8273
cancer.ucsf.edu

University of Colorado Cancer Center
Aurora, Colorado
720.848.0300
coloradocancercenter.org

University of Michigan
Rogel Cancer Center
Ann Arbor, Michigan
800.865.1125
mcancer.org

The University of Texas
MD Anderson Cancer Center
Houston, Texas
800.392.1611
mdanderson.org

University of Wisconsin
Carbone Cancer Center
Madison, Wisconsin
608.265.1700
uwhealth.org/cancer

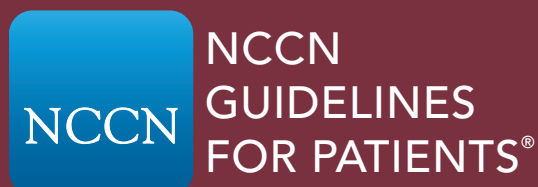
Vanderbilt-Ingram Cancer Center
Nashville, Tennessee
800.811.8480
vicc.org

Yale Cancer Center/
Smilow Cancer Hospital
New Haven, Connecticut
855.4.SMILOW
yalecancercenter.org

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Multiple Myeloma

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National Comprehensive
Cancer Network®

3025 Chemical Road, Suite 100
Plymouth Meeting, PA 19462
215.690.0300

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