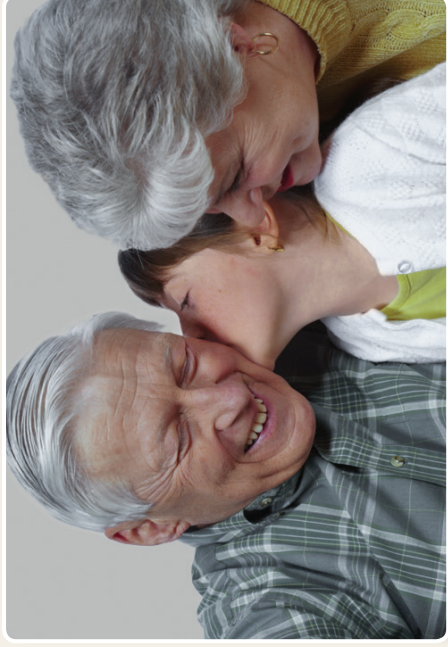




Understanding Fatigue



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A publication of the **International Myeloma Foundation**



About the International Myeloma Foundation

Founded in 1990, the International Myeloma Foundation (IMF) is the oldest and largest myeloma-specific charity in the world. With more than 350,000 members in 140 countries, the IMF serves myeloma patients, family members, and the medical community. The IMF provides a wide range of programs in the areas of **Research, Education, Support, and Advocacy**:

RESEARCH The IMF is the leader in globally collaborative myeloma research. The IMF supports lab-based research and has awarded over 100 grants to top junior and senior researchers since 1995. In addition, the IMF brings together the world's leading experts in the most successful and unique way through the International Myeloma Working Group (IMWG), which is publishing in prestigious medical journals, charting the course to a cure, mentoring the next generation of innovative investigators, and improving lives through better care.

EDUCATION The IMF's educational Patient & Family Seminars, Medical Center Workshops, and Regional Community Workshops are held around the world. These meetings provide up-to-date information presented by leading myeloma specialists and researchers directly to myeloma patients and their families. Our library of more than 100 publications, for patients and caregivers as well as for healthcare professionals, is updated annually and available free of charge. Publications are available in more than 20 languages.

SUPPORT Our toll-free InfoLine at 800-452-CURE (2873) is staffed by coordinators who answer questions and provide support and information via phone and email to thousands of families each year. The IMF sustains a network of more than 150 support groups and offers training for the hundreds of dedicated patients, caregivers, and nurses who volunteer to lead these groups in their communities.

ADVOCACY The IMF Advocacy program trains and supports concerned individuals to advocate on health issues that affect the myeloma community. Working both at the state and federal level, the IMF leads two coalitions to advocate for parity in insurance coverage. Thousands of IMF-trained advocates make a positive impact each year on issues critical to the myeloma community.

Learn more about the way the IMF is helping to improve the quality of life of myeloma patients while working toward prevention and a cure.

Contact us at **800-452-CURE (2873)** or **818-487-7455**, or visit **myeloma.org**.

Improving Lives Finding the Cure®

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The Understanding series and 10 Steps to Better Care

The IMF's *Understanding* series of booklets is designed to acquaint you with treatments and supportive care measures for **multiple myeloma** (which will be referred to as myeloma for the sake of simplicity).

For a general overview of myeloma, the IMF's *Patient Handbook* should be your first step, while the IMF's *Concise Review of the Disease and Treatment Options* is a more in-depth overview designed for healthcare professionals and knowledgeable readers outside the medical community. Both publications, as well as the many booklets in the IMF's *Understanding* series, are available on the IMF website myeloma.org, where you will find a wealth of information. You can also order copies of our booklets by calling the IMF at 800-452-CURE (2873) toll-free in the United States and Canada, or 818-487-7455 worldwide, or by sending an email to theIMF@myeloma.org.

To help you navigate the IMF website, we have organized our information according to the 10 Steps to Better Care®, which takes you from diagnosis (Step 1) through clinical trials and how to find them (Step 10). Information relevant to each step along the way, including guidelines for testing, treating, transplanting, assessing response, managing side effects, monitoring, and treating relapsed disease, is available under the appropriate step on the path to better care.

Words appearing in **bold** type are explained in the "Terms and Definitions" section at the end of this booklet. For a more complete compendium, please refer to the IMF's *Glossary of Myeloma Terms and Definitions* at glossary.myeloma.org.

What is fatigue?

Cancer or cancer treatment fatigue is a distressing, persistent, subjective sense of tiredness or exhaustion that is not proportional to recent activity and interferes with usual functioning.

In healthy people, fatigue is understood as exhaustion or tiredness that interferes to some extent with normal everyday activities. It usually occurs after strenuous or prolonged exertion of some kind and is temporary. Rest and refraining from strenuous activity can help restore energy and make a healthy person feel better.

Fatigue that is related to cancer and its treatments, however, is different and more severe than normal fatigue and tends to last longer. Simply resting does not alleviate this type of fatigue, which has been defined by the National Comprehensive Cancer Network (NCCN) as a distressing, persistent, subjective sense of tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning. Asthenia (the medical term for weakness or the loss of physical strength) often accompanies or is a component of fatigue. Cancer-related fatigue (CRF) may also be associated with difficulty concentrating, dizziness, or a disinterest in what is going on around you.

In patients with myeloma, fatigue and asthenia can be the result of many individual or collective causes. You should report persistent fatigue and/or weakness to your healthcare providers and not simply assume that they are an unavoidable consequence of your diagnosis and treatment.

What causes fatigue in patients with myeloma?

There are many causes of fatigue in myeloma patients:

- The myeloma itself
- Treatments for myeloma
- Other medical problems (known as "comorbidities") and medications for other medical problems

It can be difficult to diagnose fatigue associated with myeloma for a number of reasons. If your fatigue is the result of a source other than anemia, there are no laboratory tests that can be used to diagnose it. You must report it, or it will go undetected. Your healthcare team will need to evaluate your situation and try to identify the source or sources of your fatigue and find ways to manage it most effectively. Patients need to openly discuss their feelings of fatigue and weakness with members of their healthcare team. Do not think that feeling tired and weak is not important enough to mention at your appointments.

Grading system for fatigue

Make notes for yourself when you feel fatigued or when anything in particular makes you feel better or worse. Keep track of how limiting your fatigue is by noting to what extent it interferes with your daily activities. Any input you can provide about your fatigue and weakness will be very helpful to your healthcare team. They need your feedback so that they can determine the severity of these problems and develop strategies to help you manage them.

Based on your feedback, your healthcare team will rate your fatigue on a scale of 0 to 10 (with 0=no fatigue and 10=worst fatigue imaginable) and then classify your fatigue as one of the following:

- Mild (0 to 3)
- Moderate (4 to 6)
- Severe (7 to 10)

Important descriptors of fatigue

Examples of things that you should be looking at and want to report to your healthcare team include (but are not limited to) the following:

- Time when fatigue is most noticeable
- Medications that you are taking
- Emotional stress, anxiety, or depression
- Presence and location of physical pain
- Existence of other conditions or illnesses
- Sleep disturbances
- Dietary changes
- Changes in weight
- Changes in activity or daily routine
- Changes in health



Myeloma-related fatigue

Myeloma, like all cancers, can cause debilitating fatigue, quite apart from the fatigue caused by treating the disease. There are three common causes of fatigue in myeloma patients: myeloma-induced anemia, high levels of **cytokines**, and persistent pain, all of which can result in weight loss, decreased appetite, and fatigue and weakness. When they are combined, fatigue can be severe.

Anemia

Myeloma cells interfere with the blood-producing activities of bone marrow, often leading to a shortage of red blood cells (RBCs), or anemia. RBCs transport oxygen from the lungs to the organs and tissues around the body, and if the body does not receive enough oxygen, the result is exhaustion, shortness of breath, and the inability to carry out the activities of daily living. Anemia is often the first symptom of myeloma.

Anemia is very common in patients with myeloma. At least 60%–70% of patients with myeloma have anemia at the time they are diagnosed with the disease. Most patients with myeloma experience anemia at some point during their disease course.



If your doctor suspects you have anemia, a physical examination will be performed and your blood will be drawn for lab tests. It is wise to bring a family member or caregiver with you to your appointment. He or she may be able to add to the information you provide. Remember to report any of the following symptoms:

- Shortness of breath
- Lack of energy and motivation
- Rapid heartbeat
- Swelling in the legs, especially in the ankles
- Dizziness
- Headache
- Chills
- Change in appetite
- Decreased libido

A simple blood test is used to determine your hemoglobin level, which measures the number of RBCs in the body. Low hemoglobin levels indicate anemia. Hemoglobin is measured in units designated as grams of RBCs per deciliter of blood (g/dL). Normal hemoglobin levels are 14 to 18 g/dL for men and 12 to 16 g/dL for women. If your hemoglobin level is 2 grams or more below the level that was normal for you before your myeloma diagnosis, you are considered anemic.

For newly diagnosed patients who are anemic, the first and most important thing to do is treat the myeloma. Very often, when a treatment successfully attacks and destroys myeloma cells in the bone marrow, where all blood cells are made, the marrow will once again be able to make a normal number of RBCs, and the hemoglobin level will rise.

When a patient is being treated for myeloma and is responding well to therapy, the blood counts should ideally return to normal. However, it is often the case that blood cell counts drop as a side effect of treatment. Some of the therapies that successfully kill myeloma cells suppress the bone marrow's ability to make needed blood cells. (See "Treatment-related fatigue" section.)

Blood transfusions can replace and replenish the RBCs that you have lost and are recommended when immediate correction of the anemia is desired. Although transfusions have an immediate effect that is beneficial for patients, the increase in hemoglobin levels may not be very large and may last only up to a few weeks, so repeated transfusions may be necessary. Unfortunately, after a prolonged period of receiving transfused blood, a patient may become resistant to transfusions of blood from other people.

High levels of cytokines

Some myeloma patients have high levels of cytokines, which are known to be a source of CRF. Cytokines such as interleukins, interferon, and tumor necrosis factor alpha (TNF α) are molecules that send signals within the immune system. While cytokines are released by T-lymphocytes in response to infection or inflammation to help guard the body, they can also stimulate cancer cells' growth, hinder cancer cells' naturally programmed death (apoptosis), and aid cancer cells in spreading to other areas of the body.

In high amounts, cytokines can be toxic and lead to persistent fatigue. The effect of cytokine release is much like the fatigue you feel when fighting a viral illness such as the flu, but it lasts much longer.

Effective anti-myeloma treatment lowers the level of cytokines in the bone marrow environment where myeloma grows.

Pain

Many myeloma patients suffer from painful bone disease or from pain related to peripheral neuropathy (PN), a condition affecting the nerves in the hands and feet. PN can be caused by myeloma's effect on nerve tissue and/or by the side effects of certain treatments. Chronic, severe pain causes fatigue, and some of the most important medications used to relieve it – anticonvulsants, opiates, and antidepressants – can also cause drowsiness, loss of appetite, nausea, weight loss, and headache, all adding to fatigue.

Treatment-related fatigue

Fatigue is the most common side effect of cancer treatment.

According to the National Cancer Institute (NCI), fatigue is the most common side effect of cancer treatment. As long as there have been drugs to treat myeloma, both standard chemotherapy agents and the newer therapies (known as "novel agents"), fatigue has been a common side effect of treatment. Chemotherapy, radiation therapy, surgery, high-dose therapy with stem cell rescue, and the newer therapies (which fall into the new drug categories of **immunomodulatory drugs** and **proteasome inhibitors**) may all cause fatigue.

Chemotherapy

You may experience fatigue because therapy can kill healthy cells along with cancer cells, and the body expends extra energy to repair the healthy cells. If too many white cells are killed during therapy,

you may get an infection, contributing further to fatigue. If too many red cells are killed, anemia results. Side effects such as nausea and vomiting, insomnia, muscle wasting, and changes in mood may also cause fatigue and weakness, and are common when patients undergo high-dose chemotherapy (usually melphalan) with stem cell rescue.

Novel therapies

In the case of the newest proteasome inhibitor, Kyprolis® (carfilzomib), fatigue is the most common side effect patients experience (50% of the patients in clinical trials reported fatigue), and it can be cumulative, increasing in severity over the duration of treatment. For more information, see the IMF's booklet *Understanding Kyprolis® (carfilzomib) for Injection*.

Fatigue is also a commonly reported side effect of Pomalyst® (pomalidomide), Revlimid® (lenalidomide), and Velcade® (bortezomib), for reasons known and unknown. These drugs can all impair the production of new blood cells, leading to anemia and infection, but there are other factors, including increased cytokine levels, that can cause fatigue. With these drugs, fatigue may improve over time with duration of treatment. Doctors have reported that asthenia and fatigue often improve as the myeloma disease burden decreases, usually after the first two cycles of therapy. In the case of Velcade, patients may develop PN, and some cases of PN are painful, which is in itself fatiguing. Add to this the use of pain medications of various types that can also cause fatigue, and this side effect can be an ongoing concern.

Thalomid® (thalidomide), the earliest novel therapy, not only causes PN and

drowsiness, but can also suppress the function of the thyroid gland, causing hypothyroidism (low levels of secretion of thyroid hormone) which slows down the metabolism so that the body does not burn calories from food fast enough to provide adequate energy.

Steroids

Steroids (dexamethasone, prednisone, and methylprednisolone), which are part of almost every treatment regimen for myeloma, can cause insomnia, affect mood, suppress the immune response, and cause muscle wasting, all of which result in fatigue and weakness. Steroids can cause a number of other serious side effects as well, and should be monitored closely. You may need the full prescribed dose of dexamethasone initially to get the myeloma under control, but if you are receiving therapy with steroids and are experiencing side effects that threaten your health and/or quality of life, you must report them to your doctor, who will adjust your dose or schedule, change the steroid you're taking, or give you a "steroid vacation."

Radiation therapy

Radiation therapy is known to cause fatigue regardless of the site being treated, and it seems to grow worse over time. Fatigue from radiation therapy usually lasts 3–4 weeks after the treatment ends, but may last up to 3 months. Up to 80% of patients report fatigue during treatment, and up to 30% report it at follow-up visits. Not only does radiation therapy damage both healthy cells and cancer cells, requiring extra energy to repair cellular damage, but if you are having radiation therapy in the upper chest or neck area, the thyroid

gland may be affected, causing hypothyroidism. As is noted above, hypothyroidism slows down the body's metabolism so that it does not break down food fast enough to provide adequate energy.

Managing treatment-related fatigue

Anemia

Treatments for myeloma can reduce all the blood cell counts, including RBCs, and thus can cause anemia. If your treatment is the cause of the anemia, and the myeloma is improving while the treatment is taking a toll on your red blood cells, your doctor may order a blood transfusion and/or an **erythropoiesis** stimulating agent, or ESA. These agents (Procrit®, Epogen®, or Neulasta®) can be used to stimulate the production of RBCs only when there is a concomitant chemotherapy agent in use, and carry their own side effects and risks. They should be used with caution in light of their association with increased tumor growth and reduced survival in patients with cancer, and the identification of receptors for them on myeloma cells.

Neutropenia

If your treatment is causing lowered white cell counts (neutropenia), and you develop an infection, treatment with antibiotics and antivirals and the support of a drug that stimulates white cell production (such as Neupogen®) can help to treat the problem underlying the infection and fatigue, and will help prevent it from occurring again.

Other options for managing treatment-related fatigue

Your doctor can assess your level of fatigue and the extent to which it impairs

your quality of life, and either reduce your dose of medication, suggest a better time of day to take or receive it, or stop it until your fatigue improves.

- If your fatigue is severe enough to prevent you from performing the normal activities of daily living, the doctor can prescribe drugs that are taken at low doses early in the morning to ensure that you are able to be more active during the day:
 - Provigil® (armodafinil)
 - Ritalin® (methylphenidate)
 - Adderall® (amphetamine and dextroamphetamine)

- At the 2012 American Society of Clinical Oncology (ASCO) annual meeting, the results of a phase III trial using Wisconsin ginseng to treat CRF were presented by Debra Barton, RN, PhD (Mayo Clinic, Rochester, MN). The results of this trial were published in the *Journal of the National Cancer Institute*, July 13, 2013, concluding that data support the benefit of American ginseng, 2000 mg daily, on CRF over an 8-week period. There were no discernable toxicities associated with the treatment. The researchers discovered that patients who were receiving anti-cancer treatment at the time they took the ginseng responded better than those who were not currently being treated. Further clinical trials to validate these results are needed, but it is encouraging to know that a widely available and inexpensive herbal agent with minimal side effects may be helpful for treatment-related fatigue.

- It is also worth mentioning that at the time this publication is being written,



many clinical trials are being conducted with various approaches to helping cancer patients better manage their CRF. The NCI clinical trials database will enable you to find clinical trials testing various methods to manage CRF. Current clinical trials for CRF include those testing:

- Ginseng
- Other herbs
- Acupressure
- Acupuncture
- Exercise programs
- Prescription drugs

Other possible causes of fatigue

Medications for other medical conditions

Another factor to consider in treatment-related fatigue is other drugs you may be taking for other medical conditions while you are being treated for myeloma. The drugs themselves, or the combination of drugs, may be causing fatigue. If you are taking a number of drugs at once, it is best to consult with your pharmacist and

provide him or her with a complete list of the medications (with correct dosages) you're taking. Your pharmacist can help you by checking for drug side effects and interactions. There may be other versions of drugs you can take that do not cause the same side effects, or other schedules you can follow for your drug regimens.

Drugs for the following conditions that are common among myeloma patients may all cause fatigue:

- **High blood pressure medications** may slow down the pumping action of the heart as well as depress the central nervous system.
- **Statins** used to treat high cholesterol stop the production of muscle growth, and some researchers think that they also interfere with the production of energy at the cellular level.
- **Proton pump inhibitors** used to treat gastroesophageal reflux disease (GERD) and related disorders frequently lead to low levels of magnesium in the blood, which can cause loss of appetite, fatigue, and weakness.
- **Tranquilizers (benzodiazepines)** are used to treat a variety of anxiety disorders, agitation and muscle spasms, neuropathic pain, and seizures. They can cause sedation and fatigue by suppressing activity in parts of the central nervous system.
- **Antidepressants** are used not only to treat depression, but are also prescribed for neuropathic pain, anxiety disorders, obsessive compulsive disorder, and some hormone-related disorders. Researchers believe that they cause fatigue through their effect on hormones and on neurotransmitters in

the brain. They can also lower levels of potassium, causing muscle weakness.

- **Antibiotics** can affect some people with feelings of tiredness and extreme fatigue, although researchers have not discovered why. Certainly the changes in bowel habits and food and nutrient absorption that can occur with antibiotics can cause fatigue and listlessness. The package inserts of many antibiotics (e.g., Bactrim DS®, Keflex®, Zithromax®) list fatigue or somnolence (sleepiness) as a potential side effect.

- **Diuretics**, prescribed to control high blood pressure, glaucoma, edema (fluid retention that causes swelling), and other conditions, can interfere with the balance of **electrolytes** (potassium, sodium, chloride, calcium, magnesium) in the body. In addition to many other serious problems, electrolyte imbalances can cause extreme fatigue, muscle weakness, and pain in joints, bones, and muscles.

- **Sleep aids** interact with the same neurotransmitters in the brain as tranquilizers, and can also cause fatigue. Patients fighting the insomnia caused by dexamethasone may add to their post-dex fatigue by using certain sleeping medications.

- **Anti-emetics**, prescribed to control nausea and vomiting, can also cause fatigue and asthenia through their effects on neurotransmitters.

- **Antihistamines** such as Benadryl® (diphenhydramine) are used to inhibit allergic response and are frequently given to prevent drug reactions. They are also given to people to help them sleep, and thus can add to the general feeling of listlessness and fatigue.

Anxiety and depression

Anxiety, stress, and depression frequently accompany a cancer diagnosis. It is almost abnormal NOT to feel anxious and depressed when faced with a life-threatening illness. Patients are anxious and depressed about having cancer and the unknown course ahead, about the financial impact, and about meeting expectations at work and in the family. Stress, depression, and fatigue go hand in hand. Insomnia often accompanies these feelings, aggravating the cycle of depression, sleeplessness, and fatigue.

It's often difficult to know whether depression causes fatigue or vice versa, but it's important to try to determine if depression is the primary problem. It is most helpful to talk to your doctor about your feelings, and to seek a support system to help you manage your mental health. For some patients, the need for good emotional support can be met within the community of family and friends; others find meditation and relaxation techniques helpful; others seek membership in a support group with fellow myeloma patients; many seek professional help from a psychologist or psychiatrist. There is no stigma attached to seeking help at this time in your life, or to taking a medication for depression or anxiety that will help you feel and function better.

Poor nutrition

Fatigue can be the result of not eating enough or not getting enough calories, vitamins, and minerals from what you are eating. There are many reasons myeloma patients and cancer patients in general do not receive enough nutrition. Even when patients eat the same amount they did

before diagnosis, they may lose weight because the body may not be able to absorb and use all available nutrients. Additionally, a growing tumor, an infection, a fever, and shortness of breath can all cause an increase in the amount of energy the body needs each day. Patients are often dealing with treatments that cause nausea, diarrhea, constipation, or anorexia (appetite loss), and with emotional stress that dampens appetite.

Maintaining good nutrition is vital to fighting fatigue. You need 15 calories for every pound of your weight each day to keep your weight stable. If you have lost weight, you need an extra 500 calories each day. If you are undergoing treatment, it's important to eat protein, because protein repairs and rebuilds damaged cells. The best sources of protein are from the dairy and meat groups. (If you are not a committed vegan or vegetarian prior to diagnosis, it's not the best time to adopt those diets when you're being treated for cancer.) The NCI publication *Eating Hints*, available on the cancer.gov website, is free and can help you address your special dietary needs during treatment.

Dehydration can also drain your energy. Make sure that you are drinking enough liquids to restore what may be lost with vomiting or diarrhea. All myeloma patients, but especially those with kidney dysfunction, must drink plenty of water to flush out the kidneys and reduce the side effects of medications.

Reduced activity

Contrary to widely held opinion, resting and napping is not the best remedy for CRF. Inactivity deepens fatigue. Experts now recommend frequent light exercise

to reduce stress, build and maintain bone and muscle, improve endurance, and reduce fatigue. Walking just a short distance and trying to go a little farther each day can help you gain strength. If bone pain makes it difficult to walk or do other exercise, swimming or treading water can be a non-stressful and very effective substitute. The resistance of the water helps to build muscle strength.

Sometimes simply forcing yourself to keep up with your normal schedule and not give in to fatigue – using “mind over matter” – can get you through a bad day. At other times, doing something you enjoy can distract and restore you, and help overcome fatigue. To conserve energy, try alternating sedentary and more physically demanding activities, and schedule activities at your times of peak energy. Discuss all exercise plans with the doctor treating your myeloma and get clearance for anything you plan to do. Exercise should be tailored to your bone health and overall fitness.

Going forward

Good communication with your healthcare team is essential. If any changes have occurred that you think could be adding to your fatigue, do not hesitate to bring them to the attention of your nurses and doctors. Some factors that may not be obvious could be making your fatigue worse, and many are treatable. Your healthcare team can work with you and your caregiver(s) to develop a plan for you.

Depending on their findings, they may do the following:

- Adjust your medications
- Change or modify your dietary intake

- Improve your fluid and electrolyte intake
- Treat the underlying cause(s) as is appropriate
- Prescribe drugs that can help you be more wakeful during the day
- Create strategies for coping with and managing your fatigue
- Suggest a clinical trial, if appropriate, for treating fatigue

Along with transfusions, medications, and dose and schedule adjustments that the doctor can help with, there are also a number of other things you can do to manage and cope with your fatigue, including the following:

- Exercise (walking, swimming, gentle yoga)
- Developing coping strategies (doing things you enjoy, seeing people you enjoy)
- Modification of activities (re-establishment of priorities, use of labor-saving devices, getting a good night's sleep)
- Counseling

Involve your family and caregivers. They can be great support. Do not be ashamed or afraid to talk about your fatigue and the impact it has on your life. Good communication with your healthcare team is essential while you are a myeloma patient.

Being a good patient means reporting side effects promptly and clearly, not keeping silent so as not to “bother” the doctor. Your doctor cannot ensure effective treatment with good quality of life unless you play an active role in your own care.

The IMF InfoLine is here to help facilitate the best possible dialogue with your healthcare team, and to help you

in any way we can. Please call us at 800-452-CURE (2873) or 818-487-7455, or write to InfoLine@myeloma.org.

Terms and definitions

Anemia: A decrease in hemoglobin contained in red blood cells, which carry oxygen to the body's tissues and organs. Anemia is usually defined as hemoglobin below 10 g/dL, with over 13–14 g/dL considered normal, and/or a decrease of ≥ 2 g/dL from the normal level for an individual.

Antibody: A protein produced by white blood cells called plasma cells to fight infection and disease.

Bone marrow: The soft, spongy tissue in the center of bones that produces white blood cells, red blood cells, and platelets. This is the tissue within which abnormal plasma cells build up to cause myeloma.

Cell: The basic unit of any living organism. Millions of microscopic cells comprise each organ and tissue in the body.

Cytokines: Proteins secreted by cells which can stimulate or inhibit growth/activity in other cells. Cytokines are produced locally (i.e., in the bone marrow) and circulate in the bloodstream. They are normally released in response to infection.

Electrolytes: Minerals in your blood and other body fluids that carry an electric charge. They affect the amount of water in your body, the acidity of your blood (pH), your muscle function, and other important processes.

Erythropoiesis: The formation of new red blood cells.

Extramedullary plasmacytoma: A tumor made up of monoclonal plasma cells that is found in soft tissue outside of the bone marrow and separate from bone.

Hematologic malignancy: A cancer of the bone marrow or blood cells.

Immunoglobulin (Ig): A protein produced by plasma cells; an essential part of the body's

immune system. Immunoglobulins attach to foreign substances (antigens) and assist in destroying them. The classes of immunoglobulins are IgG, IgA, IgD, IgE, and IgM. The non-medical word for immunoglobulin is "antibody."

Immunomodulatory drug (IMiD): An agent that affects, enhances, or suppresses the immune system.

Lytic (lysis): Dissolution or destruction of cells or tissues.

Monoclonal protein (M protein): An abnormal protein produced by myeloma cells that accumulates in and damages bone and bone marrow. A high level of M protein indicates that myeloma cells are present in large numbers.

Multiple myeloma: A cancer arising from the plasma cells in the bone marrow. The cancerous plasma cells are called myeloma cells.

Plasma cells: Special white blood cells that produce antibodies (immunoglobulins). Myeloma is a cancer of the plasma cells. Malignant plasma cells are called myeloma cells. In myeloma, malignant plasma cells produce large amounts of abnormal antibodies that lack the capability to fight infection. These abnormal antibodies are the monoclonal protein, or M-protein, that functions as a tumor marker for myeloma. Plasma cells also produce other chemicals that can cause organ and tissue damage (i.e., anemia, kidney damage, and nerve damage).

Plasmacytoma: See "Extramedullary plasmacytoma" and "Solitary plasmacytoma of the bone (SPB)"

Platelets: One of the three major blood elements, others being the red blood cells and white blood cells. Platelets plug up breaks in the blood vessel walls and release substances that stimulate blood clot formation. Platelets are the major defense against bleeding. Also called thrombocytes.

Proteasome inhibitor: Any drug that interferes with the normal function of the proteasome, an enzyme complex responsible for breaking down and recycling unwanted proteins in both normal cells and cancer cells.

Proteins: Substances composed of amino acids. Proteins are an essential part of all living organisms, especially as structural components of body tissues (such as muscle, hair, collagen, etc.), and as enzymes and antibodies.

Red blood cells (RBC, erythrocytes): Cells in the blood that contain hemoglobin and deliver oxygen to and take carbon dioxide from all parts of the body. Red cell production is stimulated by a hormone (erythropoietin) produced by the kidneys. Myeloma patients with damaged kidneys don't produce enough erythropoietin and can become anemic. Myeloma patients can also become anemic because of myeloma cells' effect on the ability of the bone marrow to make new red blood cells.

Solitary plasmacytoma of bone (SPB): A discrete, single mass of monoclonal plasma cells in a bone. The diagnosis of SPB requires a solitary bone lesion, a biopsy of which shows infiltration by plasma cells; negative imaging results for other bone lesions; absence of clonal plasma cells in a random sample of bone marrow; and no evidence of anemia, hypercalcemia, or renal involvement suggesting systemic myeloma.

White blood cells (WBC): General term for a variety of cells responsible for fighting invading germs, infection, and allergy-causing agents. These cells begin their development in the bone marrow and then travel to other parts of the body. Specific white blood cells include neutrophils, granulocytes, lymphocytes, and monocytes.

10 STEPS TO BETTER CARE® A UNIQUE TOOL FOR DIAGNOSTIC AND TREATMENT INFORMATION

One of the most daunting aspects of being diagnosed with multiple myeloma (MM) is learning about – and understanding – an unfamiliar disease that is quite complicated. From diagnosis to long-term survival, the 10 Steps to Better Care® will guide you through the MM journey:

1. Know what you're dealing with. Get the correct diagnosis.
2. Tests you really need.
3. Initial treatment options.
4. Supportive care and how to get it.
5. Transplant: Do you need one?
6. Response Assessment: Is treatment working?
7. Consolidation and/or maintenance.
8. Keeping Track of the Myeloma: Monitoring without mystery.
9. Relapse: Do you need a change in treatment?
10. New Trials: How to find them.

Visit 10steps.myeloma.org to gain a better understanding of the disease and diagnosis, and proceed through the steps to learn the best tests, treatments, supportive care, and clinical trials currently available.

As always, the International Myeloma Foundation (IMF) urges you to discuss all medical issues thoroughly with your doctor. The IMF is here to equip you with the tools to understand and better manage your MM. Visit the IMF website myeloma.org or call the IMF InfoLine at 800-452-CURE (2873), which is staffed by trained information specialists, with your questions or concerns. The IMF is here to help.

