



## Understanding **Dexamethasone** and Other Steroids



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**Founded in 1990, the International Myeloma Foundation (IMF) is the first and largest organization focusing specifically on multiple myeloma. The IMF's reach extends to more than 525,000 members in 140 countries worldwide. The IMF is dedicated to improving the quality of life of myeloma patients while working toward prevention and a cure through our four founding principles: Research, Education, Support, and Advocacy.**

**RESEARCH** The signature project of the IMF's Research division is the Black Swan Research Initiative®, a groundbreaking and collaborative effort to develop the first definitive cure for myeloma. Each year, the IMF also awards Brian D. Novis Grants, which promote research for better myeloma treatments, management, and practices in the field. In addition, more than 200 leading myeloma researchers comprise the IMF's International Myeloma Working Group (IMWG), a research body that has developed myeloma guidelines that are followed around the world. Finally, the IMF's Nurse Leadership Board (NLB), comprised of nurses from leading myeloma treatment centers, develops recommendations for the nursing care of myeloma patients.

**EDUCATION** The IMF Patient & Family Seminars and Regional Community Workshops are held around the world to provide up-to-date information presented by leading myeloma specialists and researchers directly to patients and their families. The IMF's 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** The IMF's InfoLine is staffed by information specialists who answer myeloma-related questions and provide support via phone and email to thousands of families each year. In addition, the IMF sustains a network of more than 150 myeloma 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's Advocacy team has educated and empowered thousands of individuals who make a positive impact each year on issues critical to the myeloma community. Working in the US at both federal and state levels, we lead coalitions to advocate for parity in insurance coverage. We also represent the myeloma community's interests before the US Congress and agencies such as the National Institutes of Health, the Food and Drug Administration, the Centers for Medicare and Medicaid Services, and the Veterans Administration. Outside the US, the IMF's Global Myeloma Action Network (GMAN) works to help patients gain access to treatment.

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

**Contact us at 818.487.7455 or 800.452.CURE,  
or visit [myeloma.org](http://myeloma.org).**

Improving Lives **Finding the Cure**®

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## What you will learn from this booklet

The IMF's *Understanding* series of booklets is designed to acquaint you with treatments and supportive care measures for **multiple myeloma** (which we refer to simply as "myeloma"). Words in **bold+blue** type are explained in the "Terms and definitions" section at the end of this booklet, as well as in a more complete compendium of myeloma-related vocabulary, the IMF's *Glossary of Myeloma Terms and Definitions*, located at [glossary.myeloma.org](http://glossary.myeloma.org).

Myeloma is a **cancer** that is not known to most patients at the time of diagnosis. To be empowered to play an active role in your own medical care and to make good decisions about your care with your doctor, it is vital for you to learn as much as possible about myeloma and its treatments. The information in this booklet will help you in discussions with your healthcare team. The more information you have about resources that are available to you, the better and more fruitful those discussions will be.

*Understanding Dexamethasone and Other Steroids* focuses on an important component of almost all myeloma therapies. Dexamethasone (sometimes called "dex" for short) is also known by the brand names Decadron®, Dexasone®, Diodex®, Hexadrol®, and Maxidex®. It is one of the most frequently used medications in the treatment of myeloma.

## What is dexamethasone, and how does it work?

Dexamethasone is a synthetic **adrenocortical steroid**. In the body, adrenocortical steroids are produced naturally by the **adrenal glands** and are also known as glucocorticosteroids or **corticosteroids**. These compounds will be referred to as "steroids" throughout this booklet.

Adrenal glands produce **hormones** and steroids. These steroids influence many actions of the body's systems. They are involved in regulation of carbohydrates, proteins, and fats. They also inhibit **inflammatory**, allergic, and normal immune responses. Synthetic versions can imitate the actions of the naturally occurring compounds or replace them in conditions that are associated with insufficient production of much-needed steroids that are normally produced by the adrenal glands.

Dexamethasone is available in many forms. To treat myeloma, dexamethasone is used as a tablet or as an injectable. Dexamethasone is used to treat a wide variety of medical conditions in addition to myeloma and other **hematologic malignancies**. Steroids are generally additive or

synergistic with other treatments. Steroids as a component of treatment for myeloma may also help improve other conditions, some of which are listed below:

- Endocrine disorders, including conditions in which the adrenal glands do not produce enough steroids, thyroiditis, or **hypercalcemia**.
- Rheumatic/collagen disorders, including various types of arthritis, ankylosing spondylitis, lupus, and scleroderma.
- Dermatologic diseases, including some types of rashes, redness of the skin, and mycosis fungoides (lymphoma involving the skin).
- Allergic states, including those associated with asthma, dermatitis, drug hypersensitivity, perennial and seasonal allergies, and **serum sickness**.
- Ophthalmic (eye) diseases, including a number of conditions that cause redness, swelling, and inflammation of the eyes and surrounding parts of the eyes.
- Gastrointestinal (GI) diseases, such as enteritis (inflammation of the small intestine) and colitis (inflammation of the large intestine).
- Respiratory diseases, including asthma, chronic obstructive pulmonary disease, some types of pneumonia, and sarcoidosis (inflammation of the lymph nodes and other organs).
- Hematologic disorders, including some types of **anemia**, purpura (bleeding just below the skin), and thrombocytopenia (low levels of platelets in the blood).
- Malignancies such as myeloma and some types of leukemia and lymphoma.

Dexamethasone and other steroids, particularly prednisone, prednisolone, and methylprednisolone, have many uses in the treatment of cancer. They suppress certain actions of the immune system and also inhibit **cytokines**, which are chemicals in the body that control inflammation. Dexamethasone decreases inflammation or swelling by stopping **white blood cells (WBC)**, which normally fight infection, from traveling to areas of the body where there is swelling. Its anti-inflammatory actions can stop the swelling around **tumors** (especially on the spine, brain, and bone) and the resulting pain and other symptoms caused by tumors pressing on nerve endings.

Dexamethasone can also alter normal **immune system** responses and is therefore useful in the treatment of conditions that affect the immune system, such as certain types of anemia (for example, aplastic anemia and hemolytic anemia), **thrombocytopenia**, and purpura.

To treat myeloma, dexamethasone typically is given with other agents, such as cyclophosphamide, thalidomide, Velcade® (bortezomib), Revlimid® (lenalidomide)®, Kyprolis® (carfilzomib), and Pomalyst® (pomalidomide). Steroids can increase the ability of chemotherapeutic agents and **immunomodulatory drugs** to destroy myeloma cells. In fact, dexamethasone and other steroids can sometimes be used alone to effectively treat the disease. Dexamethasone is also sometimes given in small doses intravenously along with infused therapies to help prevent possible allergic reactions and/or to help reduce nausea and vomiting.

## News on dexamethasone from clinical trials

At the 2018 annual meeting of the American Society of Hematology (ASH), data were presented in oral sessions from an important clinical trial designed especially for treatment of older and less fit myeloma patients, a group usually excluded from clinical trials. A study of Revlimid + dexamethasone (Rd) treatment plus Revlimid maintenance (Rd-R) vs continuous Rd in 199 newly-diagnosed patients who were between age 65 and age 80, and who were “intermediate-fit” on the International Myeloma Working Group (IMWG) frailty score, looked at an approved standard-of-care therapy and offered an alternative – 9 months of Rd followed by R maintenance – as a comparator to see if older and less fit patients would tolerate the regimen better.

Data showed that patients in the continuous Rd arm had more hematologic side effects (low blood cell counts), more infections, and more dose reductions than those in the Rd-R arm. **Progression-free survival (PFS)** in the Rd-R arm was 43% vs 42% with continuous Rd, and **overall survival (OS)** was 84% in the Rd-R arm vs 79% with continuous Rd. Although there wasn't a significant difference in PFS or OS between the arms, patients in the Rd-R arm tolerated the regimen better, were better able to adhere to therapy, and had better quality of life, an important consideration at any age.

## Dosages and dose scheduling used in steroid treatment

Dexamethasone is typically given in combination with one or more other agents as **induction therapy** for myeloma. It is most often given orally at a dose of 40 mg once weekly, based on the results of the ECOG E4A03 clinical trial published in *Lancet Oncology* in January 2010 with Dr. S. Vincent Rajkumar as first author. The ECOG E4A03 study is the legacy of Michael Katz, a patient, support group leader, and IMF Board member who lost his battle with myeloma in 2015. On behalf of myeloma patients everywhere, Mike advocated for a study of low-dose dexamethasone.

His perseverance and insight led to the large E4A03 study that evaluated high- and low-dose dexamethasone in combination with Revlimid in the frontline setting. The once-per-week low-dose dexamethasone schedule proved to be more effective (better survival at 1 year) and had significantly fewer **side effects** than the 4-day, 40 mg pulses that were previously the standard of care.

Since the E4A03 study, there has been ample research published on the benefits of treatment with Revlimid plus low-dose dexamethasone among patients with **relapsed** and/or **refractory** myeloma as well as those with newly diagnosed disease. Of particular note are the results from the French myeloma group (Interroupe Francophone du Myélome, IFM), which demonstrated the long-term safety and efficacy of weekly Revlimid + dexamethasone in patients with recurrent myeloma (Fouquet G, *Cancer*, August 2013) and with newly diagnosed disease in the so-called FIRST study (Benboubker L, *New England Journal of Medicine*, September 2014). Low-dose dexamethasone is also used with Pomalyst and Kyprolis and in more complex combinations, such as CyBorD (cyclophosphamide, bortezomib, and dexamethasone) and RVD (Revlimid, Velcade, dexamethasone).

Low-dose dexamethasone in combination with other agents has been well established as the standard of care in myeloma. Many oncologists are now prescribing dexamethasone at a dose lower than 40 mg per week, depending upon the age and fitness of the patient. For patients who cannot tolerate a full 40 mg per week, lower doses of dexamethasone have proven to be effective, even as low as 4 mg per week.

Investigators from Mayo Clinic (Rochester, Minnesota) presented data at ASH 2015 from a study entitled “Appropriate dose adjustment of dexamethasone does not compromise outcomes in relapsed refractory myeloma.” This study demonstrated that in heavily pretreated patients, many of whom have cumulative steroid toxicities, reducing the dose of dexamethasone in combination with Pomalyst allows patients to remain on therapy significantly longer, resulting in improved OS. A study at the Karolinska Institute (Stockholm, Sweden), which was also presented at ASH 2015, demonstrated that on achieving at least a partial response (PR) with Revlimid + dexamethasone as second-line therapy, continuing with dexamethasone in addition to Revlimid does not add any benefit.

Talk to your doctor about finding a dosing regimen that is well tolerated and appropriate to treat your myeloma.

## What are some possible side effects of dexamethasone?

As is the case with any medication, use of dexamethasone can cause some unwanted side effects. Few, if any, patients experience all of these side effects. Some patients do not experience any side effects at all while taking dexamethasone. There are precautionary measures that patients and their healthcare providers should take in order to reduce or avoid side effects. The most important precautions are described below. Patients should ask members of their healthcare team to provide greater detail about these and other possible side effects and to make recommendations about side effect management.

The longer you take a steroid, and the higher the dose, the greater are your chances of experiencing side effects. Most of these side effects can be reversed and will go away when treatment is completed. Do not stop taking any of your medications or reduce your doses on your own. Speak to your healthcare team if you are experiencing any side effects or if you have any questions.

Below are some of the more common and/or more serious possible side effects, some precautions worth remembering, and some tips on how to avoid or manage adverse events.

### Infections

Because steroids block white blood cells from reaching sites of infection, these agents may cause existing infections to get worse or allow new infections to occur. A paradoxical effect is that the white blood cell level in the blood increases because the cells are not exiting the bloodstream to enter infected tissues. Any drugs that suppress normal immune responses can make a person susceptible to infections. Steroids may actually mask signs that an infection is present. They may also decrease a person's ability to fight the start of a new infection. Therefore, patients who are taking steroids have an increased risk of all types of infections (bacterial, viral, or fungal).

#### Prevention and treatment of infections

Generally, steroids should not be administered to a patient who has a known infection. Nevertheless, there are some situations in which steroids may be important or necessary during the time that an active infection is being treated with appropriate antibiotics. For example, steroids are useful in the treatment of septic shock, an infection that involves the whole body, and in treating any serious infection that causes a major inflammatory response and/or tissue destruction.

Any sign of an infection should be brought to the attention of your healthcare team as soon as possible. Make sure you wash your hands frequently, especially after being in public places.

Patients who have never had chickenpox or measles should be especially careful to avoid exposure to these childhood diseases. If you are exposed to either illness, you should notify someone on your healthcare team as soon as you become aware of the exposure.

Patients taking dexamethasone or any other steroid should avoid being vaccinated. There are certain types of vaccines that may be given if really needed, but you must consult with your doctor before you receive any vaccines for any reason. Your doctor can tell you if the vaccine in question is safe for you to take.

### Cardiac conditions and fluid retention

Use of dexamethasone and other steroids can cause increases in blood pressure, salt and water retention, and potassium and calcium excretion. These changes are more likely to occur when steroids are taken in large doses. Salt retention may lead to edema or swelling. You may notice that your ankles and feet are swollen. Fluid retention and loss of potassium can be a problem for patients who have cardiac conditions, especially **congestive heart failure** and **hypertension**.

#### Prevention and treatment of cardiac conditions and fluid retention

Changes in diet may be needed. You may have to restrict your salt intake and take supplements to replace lost potassium and calcium. Speak with members of your healthcare team to make sure that you are eating the right foods and taking the proper supplements.

### Dermatologic effects

Patients taking dexamethasone or other steroids may notice that it takes longer than usual for wounds to heal. Patients may develop acne and rashes while taking dexamethasone. Increased sweating is seen in some patients during steroid therapy.

#### Prevention and treatment of dermatologic conditions

Be careful when you cut or scratch yourself. Proper hygiene is important. Wash any wound and keep the area clean. If you notice that a cut or wound isn't healing quickly or properly, you should call your healthcare team. Do not use any over-the-counter products to treat wounds before consulting with a member of your healthcare team.

## Endocrine effects

Steroids, including dexamethasone, may interfere with the way patients **metabolize** carbohydrates and can cause **blood glucose** levels to rise. This is especially important in patients who have diabetes. Patients with diabetes can take steroids, but additional treatment, including insulin therapy, may be needed to control blood sugar levels. Steroids can also cause menstrual irregularities.

### Prevention and treatment of endocrine effects

Patients with diabetes may need to monitor their blood glucose levels more frequently. These patients may need to adjust the doses of their insulin or diabetes medications. This decision needs to be made by healthcare professionals and not by patients themselves. If you have diabetes, tell the doctor who is treating your diabetes that you are taking dexamethasone.

Patients of childbearing age should be advised that the effects of steroids on the developing child are unknown. Women, especially those experiencing menstrual irregularities, should take added precautions not to become pregnant while taking dexamethasone.

## Gastrointestinal effects

Steroids can have various effects on your GI tract. They increase the risk of GI perforations. Therefore, patients who have peptic ulcers, diverticulitis, and ulcerative colitis should use corticosteroids cautiously to minimize the risk of perforation. For these reasons, many physicians automatically recommend antacid therapy of some type for patients taking steroids. Other possible GI side effects seen with dexamethasone therapy are increased or decreased appetite, stomach bloating, nausea, vomiting, hiccups, and heartburn.

### Prevention and treatment of gastrointestinal effects

Tell your doctor if you experience any GI side effects while taking dexamethasone and ask for advice on how to manage or avoid these events. To avoid or minimize GI irritation, dexamethasone should be taken with food or after meals. Alcoholic beverages, which also irritate the stomach, should be avoided while taking dexamethasone. Limiting intake of caffeine-containing foods and drinks (e.g., colas, coffee, tea, and chocolate) may also help. Eating small, frequent meals may decrease nausea. Antacids taken between meals may also be helpful, but should not be taken unless approved by your healthcare team. Treatment for persistent hiccups may require such prescription drugs as baclofen, chlorpromazine, or promethazine.

## General effects

Some patients may experience coughing or hoarseness. Resting the voice can help with this condition.

Use of steroids, including dexamethasone, can cause weight gain.

### Prevention and treatment of weight gain

Some weight gain is to be expected during steroid therapy. Dexamethasone has a tendency to increase patients' appetites. Patients need to control their caloric intake. Reduced carbohydrate intake is especially helpful during steroid therapy. Let your healthcare team know immediately if there is a sudden, large weight gain (more than 5 pounds over a day or two).

## Musculoskeletal effects

Because steroids decrease calcium absorption and increase its excretion, they affect bones. These effects can lead to pain and osteoporosis in adults. Patients with myeloma who are already subject to severe bone loss and bone pain must be watched carefully and given appropriate supportive care to prevent further bone damage. Patients taking steroids may also experience muscle pains because they may be losing potassium.

### Prevention and treatment of musculoskeletal effects

You may have to take supplements to replace the calcium and potassium you are losing. However, do not take any supplements on your own. You can increase your calcium intake by eating foods that have high calcium content: milk, cheese, yogurt, and other dairy products, dark green vegetables such as spinach, kale, and collard greens, canned fish such as sardines and salmon, and soybeans. Bananas and some other fruits and vegetables can be good sources of potassium. Consult with your healthcare team before you start taking any supplements or change your diet.

Many patients with myeloma receive bisphosphonate therapy as treatment for myeloma-related bone disease. Bisphosphonate therapy also combats the negative effects of steroids on bone strength and density.

## Ophthalmologic effects

Prolonged steroid treatment may produce elevated intraocular pressure that could lead to **glaucoma**, optic nerve damage, eye infections, and cataracts. Cataracts occur commonly in older age and usually take years to develop to the point where surgery is indicated. Steroids can speed up this process. With ongoing steroid treatment, it is not uncommon for myeloma patients to develop mature cataracts requiring surgery. This involves removal of the cataract and implantation of a new lens in the eye, which usually allows for enhanced vision.

### Prevention and treatment of ophthalmologic effects

Have your eyes checked regularly. Any change in vision should be reported immediately to your healthcare team.

### Psychiatric and neurologic effects

Steroids can also cause irritability, mood swings, personality changes, and severe depression. They also can cause insomnia. Emotional instability or psychotic tendencies are aggravated and may become worse during steroid therapy.

Patients also have reported experiencing headaches and dizziness.

### Prevention and treatment of psychiatric and neurologic effects

If you are having problems sleeping, ask your healthcare team if you can adjust the time you take dexamethasone so it doesn't interfere with your sleep during the night. Taking the steroids before going to bed can be very effective in allowing sleep during the night, with increased activity delayed until morning. However, regular sleep medications can be helpful or necessary for some patients.

Do not hesitate to contact your doctor if you are experiencing any mood or personality effects. Your doctor may need to reduce or stop your steroid therapy temporarily or permanently. *Do not stop steroid therapy on your own without consulting your doctor.*

Family members should be advised that you may be more irritable and difficult to live with when you are receiving steroid therapy. Counseling is a good option at this time, both for the patient and for family members. The stresses and pressures of a cancer diagnosis added to life's other challenges may lead to psychological overload not only for a patient who is receiving steroids, but for the patient's family members as well. A consultation with a family counselor can be most helpful.

### Allergic reactions

Allergic and **hypersensitivity reactions** to steroids are possible in patients who are susceptible or have had allergic responses to other drugs. Allergic reactions can include difficulty breathing, closing of the throat, swelling of lips and tongue, and hives. Such allergic reactions to steroids are exceedingly rare.

### Prevention and treatment of allergic reactions

Special precaution should be used before administering dexamethasone or any other corticosteroid to patients who have histories of any type of allergic reactions to medications. Be sure to alert your healthcare team if you have a history of allergic responses when given any medication.

**Remember: Alert your doctor or nurse if you notice any changes in your health.**

### Can other drugs interact with dexamethasone?

Interactions are possible with dexamethasone and other medications. Patients with myeloma typically need to take a number of medications to treat the disease as well as other medical conditions that also may be present. Chances of drug interactions increase with multiple medications. Below is a partial list of medications or classes of medications that may interact with dexamethasone. These interactions may increase or decrease the actions of any of the drugs. It is very important to tell your healthcare team about all prescription and over-the-counter medications, as well as any herbal preparations or vitamins that you are taking.

### Drugs that can interact with dexamethasone and other corticosteroids

- Amphotericin B and diuretics that affect potassium levels (such as amiloride, spironolactone, and triamterene).
- Antibiotics (such as erythromycin, clarithromycin, rifampicin, and azithromycin).
- Anticoagulant medications (such as warfarin and aspirin).
- Barbiturates (such as amobarbital, butalbital, pentobarbital, and secobarbital).
- Diabetes medications (such as insulin, glibenclamide, metformin).
- Cyclosporine.
- Digitalis.
- Ephedrine, which is most commonly found in weight-loss products.
- Estrogen-containing medications, including oral contraceptives and hormone-replacement therapy products.
- Nonsteroidal anti-inflammatory drugs (NSAIDs), including aspirin, ibuprofen, indomethacin, and naproxen.
- Phenytoin.

### How is dexamethasone given and are there any special considerations when taking it?

To treat myeloma, dexamethasone is typically given in an infusion or orally, either with other anti-cancer agents or alone. The amount of dexamethasone patients receive depends on many factors. To reduce the chances of side effects, the smallest dose necessary of dexamethasone that can produce the desired response should be used. Your dose of

dexamethasone should be determined by the doctor who is familiar with your case and medical history.

Dexamethasone can irritate the stomach; taking it with food can reduce the chances of this happening. Alcohol should be used cautiously or avoided altogether while taking dexamethasone, as alcohol and dexamethasone together can damage the stomach lining.

***Steroid therapy cannot be stopped abruptly. It is necessary to stop this group of drugs gradually. Abrupt discontinuation can lead to withdrawal symptoms.***

Your doctor will determine how best to administer dexamethasone to avoid or minimize adverse effects as much as possible.

## **Are other corticosteroids used in the treatment of myeloma?**

In addition to dexamethasone, other corticosteroids are used to treat patients with myeloma. Because these drugs all belong to the glucocorticosteroids class of drugs, they act very similarly and can be used to treat many of the same medical conditions. They behave the same way chemically in the body to treat diseases. Because they are so similar in their mechanisms of action, many of the side effects and associated precautions are the same. Results of clinical trials have shown these agents all to be equally effective in the treatment of myeloma. Some of the steroids may be better tolerated than others, depending on the patient and the drug.

An Italian study presented at the 2015 ASH meeting demonstrated that in post-autologous transplant maintenance therapy, the use of prednisone in combination with Revlimid added no benefit and was not well tolerated. The 2016 guidelines of the National Comprehensive Cancer Network (NCCN) list thalidomide and Revlimid without steroids as the preferred regimens for maintenance therapy.

The uses, side effects, precautions, and considerations described previously for dexamethasone are relevant for the entire class of corticosteroids and thus pertain to prednisone, prednisolone, and methylprednisolone. Prednisolone is a **metabolite** of prednisone. Methylprednisolone, although structurally similar, may be less toxic and appears to be associated with less sodium and fluid retention than prednisolone. Thus, it is worth discussing with the healthcare team if any particular type of steroid (e.g., methylprednisolone versus dexamethasone) might be more useful or appropriate in your care.

As with dexamethasone, the smallest dose necessary of the corticosteroids that can produce the desired response should be used in order to avoid or minimize unwanted side effects.

## **In closing**

While a diagnosis of cancer is something you cannot control, gaining knowledge that will improve your interaction with your doctors and nurses is something you can control, and it will have a significant impact on how well you do throughout the disease course.

This booklet is not meant to replace the advice of your doctors and nurses who are best able to answer questions about your specific healthcare management plan. The IMF intends only to provide you with information that will guide you in discussions with your healthcare team. To help ensure effective treatment with good quality of life, you must play an active role in your own medical care.

We encourage you to visit [myeloma.org](http://myeloma.org) for more information about myeloma and to contact the IMF InfoLine with your myeloma-related questions and concerns. The IMF InfoLine consistently provides callers with the most up-to-date and accurate information about myeloma in a caring and compassionate manner. IMF InfoLine specialists can be reached at [InfoLine@myeloma.org](mailto:InfoLine@myeloma.org) or 818.487.7455 or 800.452.CURE.

## **Terms and definitions**

**Adrenal glands:** Glands located at the top of the kidneys that are chiefly responsible for releasing sex hormones and cortisol, a hormone that helps human beings respond to stress.

**Adrenocortical steroid:** Any of the steroidal hormones produced by the adrenal cortex (the outer part of the adrenal gland) or their synthetic (man-made) equivalents. Also known as adrenocorticoids, glucocorticosteroids, or corticosteroids.

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

**Blood glucose:** A type of blood sugar that the body produces from the food in our diet. Glucose is transported via the bloodstream to all the cells in our body. It is our primary source of energy. Certain medications can affect our blood glucose levels. There are tests that measure and monitor blood glucose.

**Calcium:** A mineral found mainly in the hard part of bone matrix (hydroxyapatite). If produced or released in excess, it can build up in the bloodstream. See "**Hypercalcemia.**"

**Cancer:** A term for diseases in which malignant cells divide without control. Cancer cells can invade nearby tissues and spread through the bloodstream and lymphatic system to other parts of the body.

**Congestive heart failure:** A condition that occurs when the heart's pumping function is weakened, causing a series of events that result in the body retaining fluid and salt. If fluid builds up in the arms, legs, feet, ankles, lungs, or other organs, the body becomes congested.

**Corticosteroid:** A group of natural and synthetic analogues of the hormones secreted by the pituitary gland. These include the glucocorticoids used in the treatment of myeloma such as dexamethasone, prednisone, and methylprednisolone. Glucocorticoids have multiple effects and are used for a large number of conditions.

**Cytokine:** Cytokines are proteins secreted by cells which can stimulate or inhibit growth/activity in other cells. Cytokines are produced locally (for myeloma, in the bone marrow) and circulate in the bloodstream. Cytokines are normally released in response to infection.

**Frontline therapy:** A general term for the initial treatment used in an effort to achieve response in a newly diagnosed myeloma patient. Also see "**Induction therapy**" and "**Response.**"

**Glaucoma:** A disease associated with the build-up of pressure inside the eye that, if untreated, can result in vision loss and blindness.

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

**Hormones:** Chemicals produced by various glands that regulate the actions of certain cells or organs in the body.

**Hypercalcemia:** A higher than normal level of calcium in the blood. In myeloma patients, it usually results from bone breakdown with release of calcium from the bone into the bloodstream. This condition can cause a number of symptoms, including loss of appetite, nausea, thirst, fatigue, muscle weakness, restlessness, and confusion. See "**Calcium.**"

**Hypersensitivity reaction:** Undesirable reactions, sometimes in response to a medication, produced by the normal immune system, including allergies and autoimmunity. These reactions may be damaging, uncomfortable, or fatal.

**Hypertension:** A chronic medical condition in which the blood pressure in the arteries is elevated. Also known as high blood pressure.

**Immune system:** The body's defense system from pathogens and foreign substances destroys infected and malignant cells, and removes cellular debris. The immune system includes white blood cells and organs and tissues of the lymphatic system.

**Immunomodulatory drug:** An agent that affects, enhances, or suppresses the immune system. Sometimes called an IMiD® compound.

**Induction therapy:** A specific term used for the initial treatment given to a patient in preparation for an autologous stem cell transplant (ASCT). Also see "**Frontline therapy**" and "**Line of therapy.**"

**Inflammatory:** Relating to inflammation, a protective response of the body against injury or disease.

**Line of therapy:** A term used to calculate the number of therapies a patient has received. Induction therapy + an autologous stem cell transplant (ASCT) is considered a single line of therapy. See "**Induction therapy.**"

**Metabolism:** The conversion of one compound into another compound, which occurs during a living organism's life-sustaining chemical processes. See "**Metabolite.**"

**Metabolite:** Any substance that is formed during metabolism or that is necessary for metabolism. See "**Metabolism.**"

**Multiple myeloma:** A cancer of the bone marrow plasma cells, white blood cells that make antibodies. The cancerous plasma cells are called myeloma cells.

**Overall survival (OS):** The median number of individuals in a group who are alive after a particular duration of time. OS is often used as a measure of treatment efficacy in clinical trials. The lengthening duration of OS in myeloma trials makes it a difficult endpoint to use, leading to the effort to validate minimal residual disease status as a new endpoint.

**Progression-free survival (PFS):** The length of time during and after the treatment of a disease, such as cancer, that a patient lives with the disease but it does not get worse. In a clinical trial, measuring the PFS is one way to determine how well a new treatment works. Also called PFS. See "**Progressive disease.**"

**Progressive disease:** Myeloma that is becoming worse or relapsing, as documented by tests. Defined as an increase of  $\geq 25\%$  from lowest confirmed response value in the myeloma protein level and/or new evidence of disease.

**Refractory:** Disease that is no longer responsive to standard treatments. Patients with refractory myeloma have had progressive disease either during treatment or within 60 days following treatment. Most clinical trials for advanced disease are for patients with relapsed and/or refractory myeloma.

**Relapse:** The reappearance of signs and symptoms of a disease after a period of improvement. Patients with relapsed disease have been treated, then developed signs and symptoms of myeloma at least 60 days after treatment ended. Most clinical trials for advanced disease are for patients with relapsed and/or refractory myeloma.

**Response or remission:** Complete or partial disappearance of the signs and symptoms of cancer. Remission and response are interchangeable terms.

- **Stringent complete response (sCR)** – sCR is CR (as defined below) plus normal FLC ratio and absence of clonal cells in bone marrow by immunohistochemistry or immunofluorescence.
- **Complete response (CR)** – For myeloma, CR is negative immunofixation on serum (blood) and urine, and disappearance of any soft tissue plasmacytomas, and  $\leq 5\%$  plasma cells in bone marrow. CR is not the same as a cure.
- **Very good partial response (VGPR)** – VGPR is less than CR. VGPR is serum M-protein and urine M-protein detectable by immunofixation but not on electrophoresis, or 90% or greater reduction in serum M-protein, plus urine M-protein less than 100 mg per 24 hours.
- **Partial response (PR)** – PR is a level of response in which there is at least a 50% reduction in M-protein, and reduction in 24-hour urinary M-protein by at least 90% (or to less than 200 mg per 24 hours).

**Serum sickness:** A hypersensitivity reaction caused by the administration of a foreign serum; it causes fever, swelling, skin rash, and enlargement of the lymph nodes.

**Side effect:** Unwanted effect caused by a drug. Also known as adverse reaction or adverse event (AE).

**Thrombocytopenia:** A low number of platelets in the blood. “Normal” levels vary from laboratory to laboratory. The normal level at the Mayo Clinic is 150,000–450,000. If the platelet count is less than 50,000, bleeding problems could occur. Major bleeding is usually associated with a reduction to less than 10,000.

**Tumor:** An abnormal mass of tissue that results from excessive cell division. In myeloma, a tumor is referred to as a plasmacytoma.

**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 bone marrow and then travel to other parts of the body. Specific white blood cells include neutrophils, basophils, eosinophils, lymphocytes, and monocytes.



## You are not alone. The IMF is here to help.

Myeloma is a cancer that is not known to most patients at the time of diagnosis. To be empowered to play an active role in your own medical care and to make good decisions about your care with your doctor, it is vital for you to learn as much as possible about myeloma and its treatments.

The IMF produces and maintains a library of publications to help arm you with one of the most important weapons in the fight against myeloma: INFORMATION. The following is a partial list of publications available in English, and selected titles are also available in other languages.

- *Patient Handbook*
- *Concise Review of the Disease and Treatment Options*
- *Understanding Clinical Trials*
- *Understanding Dexamethasone and Other Steroids*
- *Understanding DARZALEX® (daratumumab)*
- *Understanding EMPLICITI® (elotuzumab)*
- *Understanding Fatigue*
- *Understanding High-Dose Therapy with Stem Cell Rescue*
- *Understanding the Immune System in Myeloma*
- *Understanding KYPROLIS® (carfilzomib)*
- *Understanding MGUS and Smoldering Multiple Myeloma*
- *Understanding NINLARO® (ixazomib) capsules*
- *Understanding POMALYST® (pomalidomide)*
- *Understanding REVLIMID® (lenalidomide)*
- *Understanding Treatment of Myeloma Bone Disease*
- *Understanding Treatment of Myeloma-Induced Vertebral Compression Fractures*
- *Understanding VELCADE® (bortezomib)*
- *Understanding Your Test Results*

All IMF publications and periodicals are always free of charge. Visit [publications.myeloma.org](http://publications.myeloma.org) to read, download, or order printed copies. Subscribe to IMF periodicals at [subscribe.myeloma.org](http://subscribe.myeloma.org) or by contacting the IMF.

As always, the IMF urges you to discuss all medical issues with your doctor, and to contact the IMF's InfoLine specialists with your myeloma questions and concerns.