

Doxorubicin (Adriamycin, Rubex)

[Read more about our content writing process](#)

Pronounced: DOX-oh-ROO-bi-sin

Classification: Anthracycline

About Doxorubicin (Adriamycin, Rubex)

Anthracyclines work by interrupting the copying of DNA, which is necessary for cancer cell growth. This causes the cancer cells to die, slowing or stopping tumor growth. Doxorubicin interferes with the growth of cancer cells and slows their spread in the body by inhibiting DNA synthesis and causing the production of harmful free radicals.

How to Take Doxorubicin

Doxorubicin is given through an intravenous (IV, into a vein) infusion or injection. It can be given alone or with other drugs. The dosage and schedule are determined by the person's size, type of cancer, and mode of administration.

Even when carefully and correctly administered by trained personnel, this drug may cause a feeling of burning and pain. There is a risk that this medication may leak out of the vein at the injection site, resulting in tissue damage that can be severe. If the area of injection becomes red, swollen, or painful at any time during or after the injection, notify your care team immediately. Do not apply anything to the site unless instructed by your care team.

This medication is red and your urine may appear orange or reddish in color for 1-2 days after the infusion. This is not blood. This is expected as the medication is cleared from your body. If the red urine continues past two days or if you have other urinary symptoms, such as frequency or painful urination, call your healthcare provider.

The blood levels and effectiveness of this medication can be affected by certain foods and medications, so they should be avoided. These include verapamil, phenytoin, fluconazole, voriconazole, St. John's wort, phenobarbital, trastuzumab, dexrazoxane, and 6-mercaptopurine, among others. Be sure to tell your healthcare provider about all medications and supplements you take.

Possible Side Effects of Doxorubicin

There are a number of things you can do to manage the side effects of doxorubicin. Talk to your care team about these recommendations. They can help you decide what will work best for you. These are some of the most common or important side effects:

Heart Problems

In rare cases, the heart muscle can be damaged by this medication, causing heart failure and cardiomyopathy. This heart damage can occur during therapy or many months to years after treatment. The risk is highest at higher doses, in patients who receive other cardio-toxic medications, radiation to the chest area, and in children. There is a maximum lifetime dose that you can receive of this medication. Your provider may order tests to check your heart function before you begin treatment or if any symptoms arise.

It is important that you report immediately to your healthcare provider any shortness of breath, cough, ankle swelling, chest pain, rapid or irregular heartbeats.

Secondary Cancers

A secondary cancer is one that develops as a result of cancer treatment for another cancer. This is quite rare, but you should be

aware of the risk. In most cases, a secondary cancer related to chemotherapy is a blood cancer (leukemia, lymphoma). This can occur years after treatment. This is most often associated with repeated treatments or high doses. Your provider will monitor your labs closely. Consider having a complete blood count with differential checked annually by your healthcare provider if you received high-risk therapies.

Low White Blood Cell Count (Leukopenia or Neutropenia)

White blood cells (WBC) are important for fighting infection. While receiving treatment, your [WBC count can drop](#), putting you at a higher risk of getting an infection. You should let your doctor or nurse know right away if you have a fever (temperature greater than 100.4° F or 38° C), sore throat or cold, shortness of breath, cough, burning with urination, or a sore that doesn't heal.

Tips to preventing infection:

- [Washing hands](#), both yours and your visitors, is the best way to prevent the spread of infection.
- Avoid large crowds and people who are sick (i.e.: those who have a cold, fever, or cough or live with someone with these symptoms).
- When working in your yard, wear protective clothing including long pants and gloves.
- Do not handle pet waste.
- Keep all cuts or scratches clean.
- Shower or bath daily and perform frequent [mouth care](#).
- Do not cut cuticles or ingrown nails. You may wear nail polish, but not fake nails.
- Ask your oncology care team before scheduling dental appointments or procedures.
- Ask your oncology care team before you, or someone you live with has any vaccinations.

Low Red Blood Cell Count (Anemia)

Your red blood cells are responsible for carrying oxygen to the tissues in your body. When the [red cell count is low](#), you may feel tired or weak. You should let your oncology care team know if you experience any shortness of breath, difficulty breathing, or pain in your chest. If the count gets too low, you may receive a blood transfusion.

Low Platelet Count (Thrombocytopenia)

Platelets help your blood clot, so when the [count is low](#) you are at a higher risk of bleeding. Let your oncology care team know if you have any excess bruising or bleeding, including nose bleeds, bleeding gums, or blood in your urine or stool. If the platelet count becomes too low, you may receive a transfusion of platelets.

- Do not use a razor (an electric razor is fine).
- Avoid contact sports and activities that can result in injury or bleeding.
- Do not take aspirin (salicylic acid), non-steroidal, anti-inflammatory medications (NSAIDs) such as Motrin/Advil (ibuprofen), Aleve (naproxen), Celebrex (celecoxib), etc. as these can all increase the risk of bleeding. Please consult with your healthcare team regarding the use of these agents and all over-the-counter medications/supplements while on therapy.
- Do not floss or use toothpicks and use a soft-bristle toothbrush to brush your teeth.

Loss or Thinning of Scalp and Body Hair (Alopecia)

Your hair may become [thin, brittle, or may fall out](#). This typically begins two to three weeks after treatment starts. This hair loss can be all body hair, including pubic, underarm, legs/arms, eyelashes, and nose hairs. The use of scarves, wigs, hats, and hairpieces may help. Hair generally starts to regrow soon after treatment is completed. Remember your hair helps keep you warm in cold weather, so a hat is particularly important in cold weather or to protect you from the sun.

Nausea and/or Vomiting

Talk to your oncology care team so they can prescribe medications to help you manage [nausea and vomiting](#). In addition, dietary changes may help. Avoid things that may worsen the symptoms, such as heavy or greasy/fatty, spicy or acidic foods (lemons, tomatoes, oranges). Try saltines, or ginger ale to lessen symptoms.

Call your oncology care team if you are unable to keep fluids down for more than 12 hours or if you feel lightheaded or dizzy at any time.

Diarrhea

Your oncology care team can recommend medications to relieve [diarrhea](#). Also, try eating [low-fiber](#), bland foods, such as white rice and boiled or baked chicken. Avoid raw fruits, vegetables, whole-grain breads, cereals, and seeds. Soluble fiber is found in some foods and absorbs fluid, which can help relieve diarrhea. Foods high in soluble fiber include applesauce, bananas (ripe), canned fruit, orange sections, boiled potatoes, white rice, products made with white flour, oatmeal, cream of rice, cream of wheat, and farina. Drink 8-10 glasses of non-alcoholic, un-caffeinated fluid a day to prevent dehydration.

Mouth Ulcers (Mucositis)

Certain cancer treatments can cause [sores or soreness in your mouth](#) and/or throat. Notify your oncology care team if your mouth, tongue, inside of your cheek or throat becomes white, ulcerated or painful. Performing [regular mouth care](#) can help prevent or manage mouth sores. If mouth sores become painful, your doctor or nurse can recommend a pain reliever.

- Brush with a soft-bristle toothbrush or cotton swab twice a day.
- Avoid mouthwashes that contain alcohol. A baking soda and/or salt with warm water mouth rinse (2 level teaspoons of baking soda or 1 level teaspoon of salt in an eight-ounce glass of warm water) is recommended 4 times daily.
- If your mouth becomes dry, eat moist foods, drink plenty of fluids (6-8 glasses), and suck on sugarless hard candy.
- Avoid smoking and chewing tobacco, drinking alcoholic beverages, and citrus juices.

Nail and Skin Changes

Your fingernails/toenails may become dark, brittle, or fall off. You may notice dry skin or changes in the color or tone of your skin. Your skin will be more sensitive to the sun, which can result in severe sunburn or rash. Sun sensitivity can last even after chemotherapy is completed. Avoid the sun between 10-2 pm, when it is strongest. Wear sunscreen (at least SPF 15) every day, wear sunglasses and long sleeves/pants to protect your skin. Keep your fingernails and toenails clean and dry. You may use nail polish, but do not wear fake nails. If any nails fall off, clean the nail bed well with soap and water and cover with a bandaid.

Less common, but important side effects can include:

- **Radiation Recall:** Radiation recall is when the administration of a medication causes a skin reaction that looks like a sunburn (redness, swelling, soreness, peeling skin) in areas where radiation was previously given. Notify your oncology team if you notice this side effect. Treatment can include topical steroid ointments and a delay in your next chemotherapy dose.
- **Tumor Lysis Syndrome:** If there are a large amount of tumor cells in your body prior to treatment, you are at risk for tumor lysis syndrome. This happens when the tumor cells die too quickly and their waste overwhelms the body. You may be given a medication (allopurinol) and IV fluids to help prevent this. If you experience nausea, vomiting, diarrhea or become lethargic (drowsy, sluggish), notify your oncology team right away. TLS can affect your kidney function. Your provider will monitor your kidney function with blood work. Notify your provider if you have little or no urine output.

Sexual & Reproductive Concerns

This drug may affect your reproductive system, resulting in the menstrual cycle or sperm production becoming irregular or stopping permanently. Women may experience menopausal effects including hot flashes and [vaginal dryness](#). In addition, the desire for sex may decrease during treatment.

Exposure of an unborn child to this medication could cause birth defects, so you should not become pregnant or father a child while on this medication. Women should use effective birth control during and for 6 months after treatment, even if your menstrual cycle stops. Men should use condoms during and for three months after treatment even if believe you are not producing sperm. If you have a pregnant partner, you should use condoms during and for 10 days after the last dose. You may want to consider sperm banking or egg harvesting if you may wish to have a child in the future. Discuss these options with your oncology team. You should not breastfeed while receiving this medication.

Vincristine (Oncovin®, Vincasar PFS®, VCR)

[Read more about our content writing process](#)

Pronounced: vin-KRIS-teen

Classification: Antimicrotubule Agent

About Vincristine (Oncovin®, Vincasar PFS®, VCR)

Vincristine is a member of the vinca alkaloids family of chemotherapy agents. These medications work by interfering with cell division, which leaves the tumor unable to grow and spread. Vincristine was developed from the periwinkle plant.

How to Take Vincristine

This medication is administered intravenously (IV, into a vein) by a trained professional. Specific dosage and dosing schedules depend on the person's size and the type of cancer being treated.

This medication is a vesicant. Even when carefully and correctly administered by trained personnel, this drug may cause a feeling of burning and pain. There is a risk that this medication may leak out of the vein at the injection site, resulting in tissue damage that can be severe. If the area of injection becomes red, swollen, or painful at any time during or after the injection, notify your doctor or nurse immediately. Do not apply anything to the site unless instructed by your doctor or nurse.

The blood levels of this medication can be affected by certain foods and medications, so they should be avoided. These include grapefruit, grapefruit juice, ketoconazole, rifampin, phenytoin, St. John's wort, and many anti-fungal medications. Be sure to tell your healthcare provider about all medications and supplements you take.

Possible Side Effects of Vincristine

There are a number of things you can do to manage the side effects of vincristine. Talk to your care team about these recommendations. They can help you decide what will work best for you. These are some of the most common or important side effects:

Constipation

Vincristine can cause serious constipation, abdominal pain and can even lead to a blockage or stoppage of the bowel (called paralytic ileus) if not treated promptly. There are several things you can do to prevent or relieve constipation. Include fiber in your diet (fruits and vegetables), drink 8-10 glasses of non-alcoholic fluids a day, and keep active. A stool softener once or twice a day may prevent constipation. If you do not have a bowel movement for 2-3 days, you should contact your healthcare team for [suggestions to relieve the constipation](#).

Neurotoxicity

This is a toxicity that affects the nerves. The most common effect is called peripheral neuropathy, which affects the nerves in the hands and feet, causing numbness or tingling, often in the pattern of a stocking or glove. This can get progressively worse with additional doses of the medication and can lead to difficulty with balance or walking. In some people, the symptoms slowly resolve after the medication is stopped, but for some, it never goes away completely. You should let your healthcare provider know if you experience numbness or tingling in the hands and feet, as they may need to adjust the doses of your medication.

The vinca alkaloid class of chemotherapies is known to cause neuropathy, but vincristine can also cause neurologic toxicity that presents as mental depression, headache, malaise, dizziness, and seizures. It can also cause toxicity of the cranial nerves, which affects the vocal cords (changes in voice), eyes (visual changes), or facial nerves (drooping of the face or mouth). Patients can develop severe pain in the jaw soon after the first treatment with vincristine, which is caused by the medication affecting the nerves. If you notice any of these problems, notify your healthcare team right away.

Low White Blood Cell Count (Leukopenia or Neutropenia)

White blood cells (WBC) are important for fighting infection. While receiving treatment, your [WBC count can drop](#), putting you at a higher risk of getting an infection. You should let your doctor or nurse know right away if you have a fever (temperature greater than 100.4° F or 38° C), sore throat or cold, shortness of breath, cough, burning with urination, or a sore that doesn't heal.

Tips to preventing infection:

- [Washing hands](#), both yours and your visitors, is the best way to prevent the spread of infection.

- Avoid large crowds and people who are sick (i.e.: those who have a cold, fever, or cough or live with someone with these symptoms).
- When working in your yard, wear protective clothing including long pants and gloves.
- Do not handle pet waste.
- Keep all cuts or scratches clean.
- Shower or bath daily and perform frequent [mouth care](#).
- Do not cut cuticles or ingrown nails. You may wear nail polish, but not fake nails.
- Ask your oncology care team before scheduling dental appointments or procedures.
- Ask your oncology care team before you, or someone you live with has any vaccinations.

Low Red Blood Cell Count (Anemia)

Your red blood cells are responsible for carrying oxygen to the tissues in your body. When the [red cell count is low](#), you may feel tired or weak. You should let your oncology care team know if you experience any shortness of breath, difficulty breathing, or pain in your chest. If the count gets too low, you may receive a blood transfusion.

Low Platelet Count (Thrombocytopenia)

Platelets help your blood clot, so when the [count is low](#) you are at a higher risk of bleeding. Let your oncology care team know if you have any excess bruising or bleeding, including nose bleeds, bleeding gums, or blood in your urine or stool. If the platelet count becomes too low, you may receive a transfusion of platelets.

- Do not use a razor (an electric razor is fine).
- Avoid contact sports and activities that can result in injury or bleeding.
- Do not take aspirin (salicylic acid), non-steroidal, anti-inflammatory medications (NSAIDs) such as Motrin/Advil (ibuprofen), Aleve (naproxen), Celebrex (celecoxib), etc. as these can all increase the risk of bleeding. Please consult with your healthcare team regarding the use of these agents and all over-the-counter medications/supplements while on therapy.
- Do not floss or use toothpicks and use a soft-bristle toothbrush to brush your teeth.

Mouth Ulcers (Sores)

Certain cancer treatments can cause [sores or soreness in your mouth](#) and/or throat. Notify your oncology care team if your mouth, tongue, inside of your cheek or throat becomes white, ulcerated, or painful. Performing [regular mouth care](#) can help prevent or manage mouth sores. If mouth sores become painful, your doctor or nurse can recommend a pain reliever.

- Brush with a soft-bristle toothbrush or cotton swab twice a day.
- Avoid mouthwashes that contain alcohol. A baking soda and/or salt with warm water mouth rinse (2 level teaspoons of baking soda or 1 level teaspoon of salt in an eight-ounce glass of warm water) is recommended 4 times daily.
- If your mouth becomes dry, eat moist foods, drink plenty of fluids (6-8 glasses), and suck on sugarless hard candy.
- Avoid smoking and chewing tobacco, drinking alcoholic beverages, and citrus juices.

Loss or Thinning of Scalp and Body Hair (Alopecia)

Your hair may become [thin, brittle, or may fall out](#). This typically begins two to three weeks after treatment starts. This hair loss can be all body hair, including pubic, underarm, legs/arms, eyelashes, and nose hairs. The use of scarves, wigs, hats, and hairpieces may help. Hair generally starts to regrow soon after treatment is completed. Remember your hair helps keep you warm in cold weather, so a hat is particularly important in cold weather or to protect you from the sun.

Fatigue

[Fatigue](#) is very common during cancer treatment and is an overwhelming feeling of exhaustion that is not usually relieved by rest. While on cancer treatment, and for a period after, you may need to adjust your schedule to manage fatigue. Plan times to rest during the day and conserve energy for more important activities. Exercise can help combat fatigue; a simple daily walk with a friend can help. Talk to your healthcare team for helpful tips on dealing with this side effect.

Nausea and/or Vomiting

Talk to your care team so they can prescribe medications to help you manage [nausea and vomiting](#). In addition, dietary

changes may help. Avoid things that may worsen the symptoms, such as heavy or greasy/fatty, spicy or acidic foods (lemons, tomatoes, oranges). Try antacids, (e.g. milk of magnesia, calcium tablets such as Tums), saltines, or ginger ale to lessen symptoms.

Call your doctor or nurse if you are unable to keep fluids down for more than 12 hours or if you feel lightheaded or dizzy at any time.

Less common, but important side effects can include:

- **Urinary retention:** This is the inability to urinate even when you feel that you need to. If you notice you are unable to urinate, you should call your healthcare team right away or go to the emergency room to be evaluated.
- **Allergic reaction:** Some patients will have an allergic reaction to the medication during the infusion or shortly after. Let your nurse know right away if you have any shortness of breath or difficulty breathing, rash, or swelling of the face.
- **Radiation Recall:** This medication may cause radiation recall. It may present as a skin reaction that looks like a sunburn (redness, swelling, soreness, peeling skin) in areas where radiation was previously given. Notify your oncology care team if you notice this side effect. Treatment can include topical steroid ointments and a delay in your next chemotherapy dose.

Sexual & Reproductive Concerns

This drug may affect your reproductive system, resulting in the menstrual cycle or sperm production becoming irregular or stopping permanently. Women may experience menopausal effects including hot flashes and [vaginal dryness](#). In addition, the desire for sex may decrease during treatment.

Exposure of an unborn child to this medication could cause birth defects, so you should not become pregnant or father a child while on this medication. Effective birth control is necessary during treatment, even if your menstrual cycle stops or you believe you are not producing sperm. You may want to consider sperm banking or egg harvesting if you may wish to have a child in the future. Discuss these options with your oncology team. You should consult with your healthcare team before breastfeeding while receiving this medication.

Prednisone (Sterapred®, Prednisone Intensol)

[Read more about our content writing process](#)

Content Contributor: Marisa Healy, BSN, RN

Pronounced: PRED-ni-sone

Classification: Glucocorticoid

About Prednisone (Sterapred®, Prednisone Intensol)

Prednisone is a corticosteroid, similar to a hormone that is made naturally in your body. Corticosteroids (sometimes abbreviated as "steroids") are used to decrease inflammation (swelling and/or redness) and thus are involved in the management of a number of diseases, including asthma, autoimmune disorders, reactions to medications, and gastrointestinal disorders (colitis), among others. Prednisone may be given to prevent a reaction to a medication, to prevent or decrease nausea or can be used in high doses to treat certain cancers.

How to Take Prednisone

Prednisone comes as a tablet to take by mouth. The tablet should be swallowed whole. You should not break or chew the tablet. Prednisone is best taken with food, as it can irritate your stomach. Your doctor will probably tell you to take your dose(s) of prednisone at certain time(s) of the day, every day. Your personal dosing schedule will depend on what the medication is being used for. If you miss a dose, take it as soon as possible. If it is too close to your next dose, skip the missed dose and resume your schedule.

Do not stop taking this medication without first speaking to your care provider as this could cause side effects such as weakness, fatigue, decreased appetite, weight loss, nausea, vomiting, diarrhea, and abdominal pain.

This medication can affect the levels of many other medications including warfarin, cyclosporine, oral birth control pills,

phenytoin, bupropion, thalidomide, erythromycin, ketoconazole, and ritonavir, among others. Be sure to tell your healthcare provider about all medications and supplements you take.

You, or anyone you live with, should avoid having live or live-attenuated vaccines while receiving this medication. These include herpes zoster (Zostavax) for shingles prevention, oral polio, measles, nasal flu vaccine (FluMist®), rotavirus, and yellow fever vaccines.

Storage and Handling

Store your medication in the original, labeled container at room temperature and in a dry location (unless otherwise directed by your healthcare provider or pharmacist). Keep containers out of reach of children and pets.

Where do I get this medication?

Prednisone is available through most pharmacies. Your oncology team will work with your prescription drug plan to identify an in-network pharmacy for the distribution of this medication.

Insurance Information

This medication may be covered under your prescription drug plan. Patient assistance may be available to qualifying individuals without prescription drug coverage. Your care team can help you find these resources if they are available.

Possible Side Effects of Prednisone

There are a number of things you can do to manage the side effects of prednisone. Talk to your care team about these recommendations. They can help you decide what will work best for you. These are some of the most common or important side effects:

Swelling

Patients may notice swelling in their hands and/or feet. Elevating the feet may help to lessen swelling in the feet and ankles. Avoid restrictive or tight clothing that may make it harder for the fluid to drain from the hands, feet, and ankles.

Increased Risk of Infection

This medication can lower your ability to fight new and current infections. Contact your provider if you are experiencing any signs of infections including fever, chills, sore throat or cold, cough or burning with urination.

Tips to preventing infection:

- [Washing hands](#), both yours and your visitors, is the best way to prevent the spread of infection.
- Avoid large crowds and people who are sick (i.e.: those who have a cold, fever, or cough or live with someone with these symptoms).
- When working in your yard, wear protective clothing including long pants and gloves.
- Do not handle pet waste.
- Keep all cuts or scratches clean.
- Shower or bath daily and perform frequent [mouth care](#).
- Do not cut cuticles or ingrown nails. You may wear nail polish, but not fake nails.
- Ask your doctor or nurse before scheduling dental appointments or procedures.
- Ask your doctor or nurse before you, or someone you live with has any vaccinations.

Weakening of the Bones (Osteoporosis)

Long-term use can lead to early osteoporosis. Your doctor may have you get a bone density scan (DEXA scan) to assess your bone health if you are on long-term therapy.

Eye Problems

Long-term use of this medication can increase the pressure in your eyes. Report any changes in vision, blurry or double vision,

and eye pain or redness.

Increase in Appetite

Prednisone can cause you to be hungrier or thirstier than usual. Drink plenty of fluids and try to make your snacks healthy ones.

Increase in Energy

Prednisone can cause an increase in energy. You may also develop insomnia, or difficulty sleeping. Taking the medication in the morning may help to prevent this.

Irritability or Change in Mood

Some patients report feeling irritable or notice a change in their mood while taking prednisone. If this becomes difficult to handle or if you feel like you may harm yourself or others, contact your healthcare provider immediately.

Nausea and Heartburn

Taking prednisone with food or milk is generally enough to prevent nausea and heartburn. If possible, take the medication when you can be upright (not lying down) for a few hours after the dose. Avoid things that worsen the symptoms, and try antacids (milk of magnesia and calcium tablets, like Tums), saltines, or ginger ale to lessen symptoms.

Increased Blood Sugar

Prednisone can increase your blood sugar. Diabetics should monitor their blood sugar closely and may require higher doses of insulin while taking prednisone. Patients who are not diabetics but are having increased blood sugar levels may be instructed to check their blood sugar and administer insulin while taking prednisone. Your provider will determine if this is necessary.

GI Bleed & Tear

This medication can cause bleeding or a tear in the intestinal wall. Signs of these problems include: unexpected bleeding, blood in the stool or black stools, coughing up blood, vomiting blood, vomit that looks like coffee grounds, fever, severe pain in the abdomen, or new abdominal swelling. If you experience any of these, contact your oncology care team immediately or go to the emergency room.

Other Side Effects

Prednisone can cause delayed wound healing, headaches, muscle weakness, and cataracts (after long-term use).

Reproductive Concerns

Exposure of an unborn child to this medication could cause birth defects in rare cases, so you should not become pregnant or father a child while on this medication. Even if your menstrual cycle stops or you believe you are not producing sperm, you could still be fertile and conceive. You should consult with your healthcare team before breastfeeding while receiving this medication.

Rituximab (Rituxan®)

[Read more about our content writing process](#)

Pronounced: ri-TUX-i-mab

Classification: Monoclonal Antibody

About Rituximab (Rituxan®)

Monoclonal antibodies are created in a lab to attach to the targets found on specific types of cancer cells. The antibody “calls” the immune system to attack the cell it is attached to, resulting in the immune system killing the cell. These antibodies can work in different ways, including stimulating the immune system to kill the cell, blocking cell growth or other functions necessary for cell growth. Rituximab is directed against a protein called CD20, found on the surface of normal and cancerous B-cells, which are part of the immune system. Once rituximab attaches itself to the B cells expressing CD20, it summons the body’s immune system to attack and destroy those cells.

How to Take Rituximab

Rituximab is given by intravenous (IV, into a vein) infusion. It may take several hours or longer to receive your first dose of rituximab. Depending on how you tolerate the medication, you may receive subsequent doses more quickly. The dosage and schedule is determined by the person's body size, type of cancer, and treatment regimen. Prior to each dose, the patient may be given medications, including acetaminophen and an antihistamine (such as diphenhydramine), to decrease the risk of an infusion reaction.

You, or anyone you live with, should avoid having live or live-attenuated vaccines while receiving this medication. These include herpes zoster (Zostavax) for shingles prevention, oral polio, measles, nasal flu vaccine (FluMist®), rotavirus and yellow fever vaccines.

Possible Side Effects of Rituximab

There are a number of things you can do to manage the side effects of rituximab. Talk to your care team about these recommendations. They can help you decide what will work best for you. These are some of the most common or important side effects:

Infusion and Allergic Reactions

Allergic or infusion reactions may occur during the treatment, typically within 30 minutes to 2 hours of beginning the first infusion. This is less common after the first treatment.

During the infusion, if you experience difficulty breathing or swallowing, experience chest pain, cough or wheezing, swelling of lips or face, develop itching, rash or hives, lightheadedness, fever, chills, or shakes inform your nurse immediately. Additional medications may be given to alleviate your discomfort. Your infusion may be slowed or temporarily stopped.

Severe Skin and Mouth Reactions

Notify your healthcare provider if you develop painful sores or blisters, on your skin, lips or inside your mouth, rash or peeling skin.

Hepatitis B Reactivation

This medication can also cause Hepatitis B reactivation in patients who have previously had hepatitis. Be sure your healthcare provider is aware of previous Hepatitis B diagnosis and treatment. You will also be tested for the Hepatitis B virus prior to beginning treatment with this medication.

Progressive Multifocal Leukoencephalopathy (PML)

Progressive Multifocal Leukoencephalopathy (PML) is a rare but very serious brain infection that has been reported with this medication. The signs of PML may develop over several weeks or months. They may include changes in mood or usual behavior, confusion, thinking problems, loss of memory, changes in vision, speech, or walking, and decreased strength or weakness on one side of the body. If you develop any of these signs, notify your oncology care team immediately.

Infection and Low White Blood Cell Count (Neutropenia)

White blood cells (WBC) are important for fighting infection. While receiving treatment, your [WBC count can drop](#), putting you at a higher risk of getting an infection. You should let your doctor or nurse know right away if you have a fever (temperature greater than 100.4° F or 38° C), sore throat or cold, shortness of breath, cough, burning with urination, or a sore that doesn't heal.

Tips to preventing infection:

- [Washing hands](#), both yours and your visitors, is the best way to prevent the spread of infection.
- Avoid large crowds and people who are sick (i.e.: those who have a cold, fever or cough or live with someone with these symptoms).
- When working in your yard, wear protective clothing including long pants and gloves.
- Do not handle pet waste.
- Keep all cuts or scratches clean.

- Shower or bath daily and perform frequent [mouth care](#).
- Do not cut cuticles or ingrown nails. You may wear nail polish, but not fake nails.
- Ask your oncology care team before scheduling dental appointments or procedures.
- Ask your oncology care team before you, or someone you live with, has any vaccinations.

Fatigue

[Fatigue](#) is very common during cancer treatment and is an overwhelming feeling of exhaustion that is not usually relieved by rest. While on cancer treatment, and for a period after, you may need to adjust your schedule to manage fatigue. Plan times to rest during the day and conserve energy for more important activities. Exercise can help combat fatigue; a simple daily walk with a friend can help. Talk to your healthcare team for helpful tips on dealing with this side effect.

Nausea and/or Vomiting

Talk to your oncology care team so they can prescribe medications to help you manage [nausea and vomiting](#). In addition, dietary changes may help. Avoid things that may worsen the symptoms, such as heavy or greasy/fatty, spicy or acidic foods (lemons, tomatoes, oranges). Try saltines, or ginger ale to lessen symptoms.

Call your oncology care team if you are unable to keep fluids down for more than 12 hours or if you feel lightheaded or dizzy at any time.

Less common, but important side effects can include:

- **GI Obstruction or Tear:** This medication can cause bleeding or a tear in the intestinal wall. Signs of these problems include: unexpected bleeding, blood in the stool or black stools, coughing up blood, vomiting blood, vomit that looks like coffee grounds, fever, severe pain in the abdomen or new abdominal swelling. If you experience any of these, contact your oncology care team immediately or go to the emergency room.
- **Flu-Like Symptoms:** You may experience flu-like symptoms, including muscle and body aches, headache, fever, and chills. Acetaminophen may help relieve these symptoms. However, fever can be a sign of an infection and should be reported to your healthcare provider.
- **Tumor Lysis Syndrome:** If there are a large amount of tumor cells in your body prior to treatment, you are at risk for tumor lysis syndrome. This happens when the tumor cells die too quickly and their waste overwhelms the body. You may be given a medication (allopurinol) and IV fluids to help prevent this. If you experience nausea, vomiting, diarrhea or become lethargic (drowsy, sluggish), notify your oncology team right away. TLS can affect your kidney function. Your provider will monitor your kidney function with blood work. Notify your provider if you have little or no urine output.
- **Heart Problems:** Rituximab can cause chest pain or irregular heartbeats. Notify your healthcare provider if you develop cardiac symptoms.
- **Kidney Problems:** This medication can cause kidney problems, including an increased creatinine level, which your oncology care team may monitor for using blood tests. Notify your healthcare provider if you notice decreased urine output, blood in the urine, swelling in the ankles, or loss of appetite.

Reproductive Concerns

Exposure of an unborn child to this medication could cause birth defects, so you should not become pregnant or father a child while on this medication. Effective birth control is necessary during treatment and for at least 12 months after treatment. Even if your menstrual cycle stops or you believe you are not producing sperm, you could still be fertile and conceive. You should not breastfeed while taking this medication or for 6 months after your last dose.

Current Biosimilars

There are biosimilar versions of rituximab. A biosimilar is a medication that has been approved by the FDA because it is very similar to an FDA-approved medication (called a reference product, or the medication it is being compared to), and that there are no meaningful differences between the biosimilar product and the reference product. These medications may be used interchangeably.

The biosimilar versions of this medication include rituximab-abbs and rituximab-pvvr.

Cyclophosphamide IV Formulation (Cytosan®, Neosar®, Endoxan®)

[Read more about our content writing process](#)

Pronounced: SYE-kloe-FOS-fa-mide

Classification: Alkylating Agent

About Cyclophosphamide IV Formulation (Cytosan®, Neosar®, Endoxan®)

Cyclophosphamide exerts its anti-cancer effect by a process called alkylation. Alkylation damages the DNA of cells, which prevents them from dividing, and causes them to die. Since cancer cells, in general, divide faster and with less error correcting than healthy cells, cancer cells are more sensitive to this damage.

How to Take Cyclophosphamide

Cyclophosphamide can be given by intravenous (IV, into a vein) infusion or taken orally (by mouth) in a pill form. This information is about the IV formulation. The dosage and schedule are determined by the person's size and type of cancer being treated.

This medication can interact with a number of medications including: metronidazole, tamoxifen, warfarin, cyclosporine, amiodarone, Echinacea, and thiazide diuretics, among others. Be sure to tell your healthcare provider about all medications and supplements you take.

Possible Side Effects

There are a number of things you can do to manage the side effect of cyclophosphamide. Talk to your care team about these recommendations. They can help you decide what will work best for you. There are some of the most common or important side effects:

Infection and Low White Blood Cell Count (Leukopenia or Neutropenia)

This medication can cause life threatening infections, with or without a decrease in white blood cell counts.

White blood cells (WBC) are important for fighting infection. While receiving treatment, your [WBC count can drop](#), putting you at a higher risk of getting an infection. You should let your doctor or nurse know right away if you have a fever (temperature greater than 100.4°F or 38°C), sore throat or cold, shortness of breath, cough, burning with urination, or a sore that doesn't heal.

Tips to preventing infection:

- [Washing hands](#), both yours and your visitors, is the best way to prevent the spread of infection.
- Avoid large crowds and people who are sick (i.e.: those who have a cold, fever or cough or live with someone with these symptoms).
- When working in your yard, wear protective clothing including long pants and gloves.
- Do not handle pet waste.
- Keep all cuts or scratches clean.
- Shower or bath daily and perform frequent [mouth care](#).
- Do not cut cuticles or ingrown nails. You may wear nail polish, but not fake nails.
- Ask your oncology care team before scheduling dental appointments or procedures.
- Ask your oncology care team before you, or someone you live with, has any vaccinations.

Low Red Blood Cell Count (Anemia)

Your red blood cells are responsible for carrying oxygen to the tissues in your body. When the [red cell count is low](#), you may feel tired or weak. You should let your oncology care team know if you experience any shortness of breath, difficulty breathing or pain in your chest. If the count gets too low, you may receive a blood transfusion.

Low Platelet Count (Thrombocytopenia)

Platelets help your blood clot, so when the [count is low](#) you are at a higher risk of bleeding. Let your oncology care team know if you have any excess bruising or bleeding, including nose bleeds, bleeding gums or blood in your urine or stool. If the platelet count becomes too low, you may receive a transfusion of platelets.

- Do not use a razor (an electric razor is fine).
- Avoid contact sports and activities that can result in injury or bleeding.
- Do not take aspirin (salicylic acid), non-steroidal, anti-inflammatory medications (NSAIDs) such as Motrin/Advil (ibuprofen), Aleve (naproxen), Celebrex (celecoxib) etc. as these can all increase the risk of bleeding. Please consult with your healthcare team regarding use of these agents and all over the counter medications/supplements while on therapy.
- Do not floss or use toothpicks and use a soft-bristle toothbrush to brush your teeth.

Nausea and/or Vomiting

Talk to your oncology care team so they can prescribe medications to help you manage [nausea and vomiting](#). In addition, dietary changes may help. Avoid things that may worsen the symptoms, such as heavy or greasy/fatty, spicy or acidic foods (lemons, tomatoes, oranges). Try saltines, or ginger ale to lessen symptoms.

Call your oncology care team if you are unable to keep fluids down for more than 12 hours or if you feel lightheaded or dizzy at any time.

Diarrhea

Your oncology care team can recommend medications to relieve [diarrhea](#). Also, try eating [low-fiber](#), bland foods, such as white rice and boiled or baked chicken. Avoid raw fruits, vegetables, whole grain breads, cereals and seeds. Soluble fiber is found in some foods and absorbs fluid, which can help relieve diarrhea. Foods high in soluble fiber include: applesauce, bananas (ripe), canned fruit, orange sections, boiled potatoes, white rice, products made with white flour, oatmeal, cream of rice, cream of wheat, and farina. Drink 8-10 glasses of non-alcoholic, un-caffeinated fluid a day to prevent dehydration.

Loss or Thinning of Scalp and Body Hair (Alopecia)

Your hair may become [thin, brittle, or may fall out](#). This typically begins two to three weeks after treatment starts. This hair loss can be all body hair, including pubic, underarm, legs/arms, eyelashes, and nose hairs. The use of scarves, wigs, hats and hairpieces may help. Hair generally starts to regrow soon after treatment is completed. Remember your hair helps keep you warm in cold weather, so a hat is particularly important in cold weather or to protect you from the sun.

Nail and Skin Changes

Your fingernails/toenails may become dark, brittle or fall off. You may notice dry skin or changes in the color or tone of your skin. Your skin may be more sensitive to the sun, which can result in severe sunburn or rash. Sun sensitivity can last even after chemotherapy is completed. Avoid the sun between 10-2pm, when it is strongest. Wear sunscreen (at least SPF 15) everyday, wear sunglasses and long sleeves/pants to protect your skin. Keep your fingernails and toenails clean and dry. You may use nail polish, but do not wear fake nails. If any nails fall off, clean the nail bed well with soap and water and cover with a band aid.

Less common, but important side effects can include:

- **Bladder Irritation:** Cyclophosphamide may irritate your bladder, cause blood in your urine, or pain with urination. Drink at least 6 to 8 glasses of fluid/day to flush out your bladder. You may be given IV fluids along with the medication to help reduce the chance of bladder irritation. Let your doctor or nurse know if you have difficulty urinating, pain, notice pink or red urine, or bleeding during urination. When given in high doses, your doctor may give you a medication to protect your bladder.
- **Secondary Malignancies:** There is a very low risk of developing leukemia or other type of cancer due to treatment with this medication, which can occur many years after treatment. This is most often associated with repeated treatments or high doses.
- **Electrolyte Abnormalities:** This medication can affect the normal levels of electrolytes (sodium, potassium, magnesium, calcium, etc.) in your body. Your levels will be monitored using blood tests. If your levels become too low, your care team may prescribe specific electrolytes to be given by IV or taken by mouth. Do not take any supplements without first

consulting with your care team.

- **Lung Changes:** This medication may cause lung changes, including pneumonitis (irritation of the lung tissue) and pulmonary fibrosis (a scarring and stiffening of the lung tissue). These problems can develop during treatment, or months to years after treatment is completed. Call your physician right away if you have new or worsening shortness of breath, cough, wheezing or difficulty breathing.
- **Heart Problems:** This medication can affect your heart function, cause abnormal heartbeats, or an abnormal heart rhythm called QT prolongation. Notify your healthcare provider right away if you develop swelling of the feet or ankles, shortness of breath, have a rapid weight gain, feel abnormal heartbeats or if you feel dizzy or faint.
- **Wound Healing:** This medication can lead to slower or incomplete wound healing, such as a surgical wound not healing or staying closed. Be sure to inform the team performing the surgical procedure that you are taking this drug. You should also inform your oncology team that a surgical procedure is planned. It is recommended that this medication be discontinued prior to any surgery. In addition, any surgical incision should be fully healed prior to starting or restarting the medication. If you have a surgical wound that has not healed or begins to have signs of infection (redness, swelling, warmth), report this to your healthcare team.
- **Veno-occlusive Liver Disease:** This medication can cause blood clots in the small veins of your liver. This can lead to liver failure. If you begin to accumulate fluid in your belly or notice that your skin or the whites of your eyes are yellowing, contact your care team immediately.

Reproductive Concerns

This medication may affect your reproductive system, resulting in the menstrual cycle or sperm production becoming irregular or stopping permanently. Women may experience menopausal effects including hot flashes and vaginal dryness. In addition, the desire for sex may decrease during treatment. You may want to consider sperm banking or egg harvesting if you may wish to have a child in the future. Discuss these options with your oncology team.

Exposure of an unborn child to this medication could cause birth defects, so you should not become pregnant or father a child while on this medication. For women, effective birth control is necessary during treatment and for at least 1 year after treatment. For men, effective birth control is necessary during treatment and for at least 4 months after treatment. Even if your menstrual cycle stops or you believe you are not producing sperm, you could still be fertile and conceive. You should not breastfeed during treatment and for at least 1 week after your last dose.

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