

Chemotherapy Drug Side Effect Information Sheets

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BLEOMYCIN

Bleomycin is a drug given by injection to treat certain cancers in dogs and cats.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Waste products should never be handled by pregnant women.

Adverse Effects and Drug Interactions

The major side effects seen shortly after a dose of bleomycin include loss of appetite, fever, vomiting, and allergic reactions. Delayed effects include loss of hair, rashes and other skin reactions and stomatitis (soreness or ulcerations occurring in the mouth and GI tract). More serious delayed reactions include fibrotic changes in the lungs and pneumonia, both of which can prove fatal. Other less commonly seen effects are low platelet and white blood cell counts, a slight decrease in hemoglobin levels, and renal and hepatic toxicity. Routine blood work is essential to monitor these effects as well as others.

Use in pregnancy is not recommended, but the benefits of treatment may be deemed to outweigh the risks to the fetus.

The use of general anesthetics in animals previously treated with bleomycin is not recommended because bleomycin makes the lung tissue more sensitive to oxygen and therefore rapid deterioration of lung function and fibrosis of the lungs can occur after surgery. Previous treatment with radiation or other chemotherapeutic drugs can lead to an increased incidence of toxicity involving the blood components, mucous membranes, and lungs. There have also been reports of increased blood levels of the anticonvulsant drug, phenytoin, and the cardiac drug digoxin with concurrent bleomycin use.

CARBOPLATIN

Carboplatin, also known by the brand name Paraplatin, is a drug used to treat certain types of cancers in dogs and cats. It is usually given intravenously, but it can also be infused into body cavities.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

The major side effects seen in dogs are loss of appetite, vomiting, and bone marrow suppression, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. In dogs, about 14 days after a treatment, these signs peak and then recovery is usually seen at 21 days. In cats, the peak is at 21 days after the dose and recovery occurs by about 28 days. If severe signs of bone marrow suppression occur, the animal should be allowed to recover to a normal range before treatment continues. Carboplatin has been shown to have adverse effects on the liver and kidneys and has been shown to be associated with hearing loss, as well as adverse effects on the nervous system.

Carboplatin should be used with caution in animals with existing liver or kidney disease, hearing impairment, or infection. It should not be used in patients with known hypersensitivity reactions to it.

Use of carboplatin during pregnancy is known to produce fetal abnormalities and should be avoided in pregnant animals. Because it may be excreted in the milk, animals should not be allowed to nurse offspring during treatment.

Any drug that can cause similar effects on the bone marrow has the potential for increasing those effects. This includes any drug that suppresses the immune system, such as azathioprine, cyclophosphamide, and corticosteroids, such as prednisone, dexamethasone, and hydrocortisone.

The immune response normally seen with a vaccine using a live or killed virus may be impaired during therapy. Carboplatin can also potentiate the effects of live virus vaccines, and an increase in side effects may be seen with such vaccines.

CHLORAMBUCIL

The brand name of this drug is Leukeran. Chlorambucil is an orally administered drug used for certain types of cancer, including lymphoma.

Storage

Chlorambucil should be stored in the refrigerator in a child-resistant package (preferably in a glass container).

Handling of the Drug and Waste Products

This drug should not be handled by pregnant women. This drug can be absorbed through skin contact and therefore should always be handled wearing protective gloves. After removing gloves, wash your hands with soap and water. Any time skin contact occurs, the area should be washed immediately with soap and water.

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Chlorambucil can suppress the bone marrow, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Another common side effect is toxicity to the GI tract, usually seen as vomiting or diarrhea. Hair loss and delayed regrowth of hair occurs sometimes in dogs.

Chlorambucil should not be used in patients with or those susceptible to bone marrow suppression or infections. It should not be given to patients with known hypersensitivity reactions to it.

In humans, chlorambucil has been associated with fetal abnormalities, and it is therefore not recommended for use in pregnant animals unless the benefit of treatment clearly outweighs the risks. It is unknown if it is secreted in milk, but to be prudent, nursing offspring should be bottle-fed while the mother is being treated.

Any drug that can cause similar effects on the bone marrow has the potential for increasing those effects; therefore, concurrent administration of drugs such as chloramphenicol, flucytosine, amphotericin B, or colchicine can increase this risk. Also, drugs that affect the immune system can have an additive effect when given with chlorambucil and increase the risk of infection; examples of such drugs are azathioprine, mycophenolate mofetil, cyclophosphamide, and corticosteroids, such as prednisone, dexamethasone, or hydrocortisone.

CISPLATIN

A brand name of this drug is Platinol. This drug is used to treat certain cancers in dogs and is given either by intravenous or intra-cavitary infusion. It has also been given by direct injection into cancerous skin lesions. It should *not* be administered to cats.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

The most common side effect seen is vomiting, and it usually occurs within 6 hours of the administration of the dose and lasts up to 6 hours. If the patient is not adequately hydrated with saline before, during, and after administration, kidney toxicity may develop. Other side effects include decreases in certain types of white blood cells and lowered platelet counts; these effects manifest as increased susceptibility to infections and increased bleeding or bruising. Routine blood work is essential to monitor these effects as well as others. Adverse effects on hearing may occur, usually seen as loss of high-frequency hearing and ringing in the ears. A loss of appetite and diarrhea (including bloody diarrhea) may also occur, as well as seizures, pain in the extremities (caused by effects on peripheral nerves), electrolyte abnormalities, increased uric acid in the urine, and increases in liver enzymes. Anaphylactic reactions and death have also occurred.

Because of effects seen on mice embryos and fetuses, it is recommended that cisplatin not be used in pregnant animals. In human males, it has been known to adversely affect sperm production.

Cisplatin can reduce serum levels of an anti-convulsant drug, phenytoin. Other drugs that can be toxic to the kidneys, such as the aminoglycoside antibiotics or amphotericin B, should not be used within 2 weeks of a dose of cisplatin.

CYCLOPHOSPHAMIDE

The brand name of this drug is Cytoxan. Cyclophosphamide is a drug given either orally or by injection to treat certain types of cancers as well as some other conditions. The drug must be metabolized to its active form by the liver.

Storage

This drug should be stored at room temperature in a child-resistant package.

Handling of the Drug and Waste Products

This drug should not be handled by pregnant women at all. This drug can be absorbed through skin contact and therefore should always be handled while wearing protective gloves. After removing gloves, wash your hands with soap and water. Any time skin contact occurs, the area should be washed immediately with soap and water.

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Cyclophosphamide can suppress the bone marrow, which is exhibited most often by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called neutrophils (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Vomiting and diarrhea are common side effects related to the action of the drug on the cells lining the GI tract. Hair loss and delayed regrowth of hair sometimes occur in dogs. Effects on the bone marrow usually peak about 7 to 14 days after treatment and may require 4 weeks for recovery. A unique adverse effect of this drug is a condition called *sterile hemorrhagic cystitis*, which initially presents with painful urination and/or blood in the urine. If these signs occur, administration of cyclophosphamide should be discontinued and the pet should be seen by the veterinarian for further tests. Other less common side effects include depression, infiltrates and fibrosis of the lungs, reduced sodium content in the body, and immunosuppression (with increased risk of infections).

Cyclophosphamide should be used with caution in animals with lowered white blood cell counts, low platelet counts, impaired liver or kidney function, patients with infections, and patients who have undergone previous treatment with radiation.

In humans, this drug causes abnormalities of the embryo and fetus, and therefore it is not recommended for use in pregnant animals. It has been shown to cause sterility in males. It is excreted in breast milk, so nursing offspring should be bottle-fed while the mother is being treated.

Phenobarbital and similar drugs can increase the metabolism of this drug, and this may increase the occurrence of toxic effects. Allopurinol and thiazide-type diuretics can increase the bone marrow suppression seen with this drug. The absorption of digoxin can be decreased by treatment with cyclophosphamide. Use with other cardiotoxic agents (such as doxorubicin) can increase the risk of cardiotoxicity.

CYTARABINE

Cytarabine, also known as Ara-C, cytosine arabinoside, and the brand name Cytosar-U, is an injectable drug used primarily in the treatment of lymphoma. It is one of the few drugs that enters the central nervous system.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Cytarabine can cause bone marrow suppression, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Loss of appetite, nausea, vomiting and diarrhea, ulcers in the mouth, fever, and liver damage may also occur. Redness and inflammation of the linings of the eyes (conjunctivitis) has also been seen.

Safe use in pregnancy has not been established, and it is generally not recommended that cytarabine be given during pregnancy.

The absorption of the drug digoxin can be affected by use of cytarabine. Limited studies have shown that cytarabine may inhibit the effectiveness of the anti-infective drugs, gentamicin and flucytosine.

DACARBAZINE

This drug, also known as DTIC, is used to treat a variety of cancers.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

GI toxicities, characterized by vomiting, diarrhea, and loss of appetite, are commonly seen. Bone marrow suppression does not necessarily cause overt symptoms, but rather may be noted when white blood cell and platelet counts are decreased several weeks after therapy. Occasionally, severe blood toxicities occur, which may be fatal. Routine blood work is essential to monitor these effects as well as others. Delayed side effects are rare but may include loss of hair, severe liver toxicity, impairment of kidney function, and photosensitivity reactions (adverse reactions to sunlight).

Dacarbazine causes birth defects in pregnant rats, so use in pregnant animals should be recommended only when the potential benefits outweigh the risk to the offspring. It is unknown if it enters maternal milk, but common practice is to wean offspring during treatment to avoid the possibility of toxicity to them.

Drugs that induce hepatic enzyme systems (such as phenobarbital) may increase the metabolism of DTIC. Other drugs that can depress bone marrow activity, such as chloramphenicol, flucytosine, colchicine, amphotericin B, or other drugs used to treat cancers, may cause an additive risk.

DACTINOMYCIN

This drug, also known as actinomycin D and the brand name Cosmegen, is used to treat a variety of cancers.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

This drug should not be given to patients with known hypersensitivity reactions to it. Dactinomycin can suppress the bone marrow, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Diarrhea and ulceration of the mouth and GI tract (stomatitis) may also occur. It can cause toxicity to the liver and is not recommended for use in cats because it is not known if the cat's liver is able to metabolize it. Dactinomycin can also cause increased uric acid levels, and patients may need to be treated with allopurinol to prevent urate stone formation.

Dactinomycin has been shown to cause damage to the embryo/fetus if used during pregnancy; it is therefore not recommended for use in pregnant animals. It is likely secreted in breast milk and therefore animals should not be allowed to nurse while being treated with it.

Drugs such as colchicine, flucytosine, amphotericin B, chloramphenicol, and other cancer chemotherapy drugs can increase the bone marrow suppression seen with dactinomycin. Cardiac toxicity can be additive if given with doxorubicin or in a sequence of treatments including doxorubicin. Patients who are taking vitamin K may require higher-than-normal doses while on dactinomycin.

DOXORUBICIN

This drug, sometimes referred to by the brand name Adriamycin, is administered intravenously to treat several types of cancer.

Handling of Waste Products After Administration

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Adverse Effects and Drug Interactions

The most common adverse effects after doxorubicin administration are loss of hair, cardiac toxicity, vomiting, diarrhea, and stomatitis (inflammation of the mucous membranes lining the mouth and GI tract). Doxorubicin often suppresses the bone marrow, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Cardiac effects can manifest immediately or after a period of time, depending on the total dose of the drug the patient has received. Your pet may undergo cardiac diagnostic tests to diagnose or monitor its cardiac function before and/or during treatment. If your pet is considered at significant risk for cardiotoxicity, your doctor may recommend treatment with a cardioprotective drug called *dexrazoxane* along with the doxorubicin. A serious adverse reaction occurs if doxorubicin is injected outside of a blood vessel. The affected area will undergo major tissue damage, likely requiring surgery or long-term wound management to resolve. In cats, this drug can cause kidney damage and renal function should be monitored before and during therapy.

Doxorubicin has been associated with fetal and embryonic abnormalities, and it is therefore not recommended for use in pregnant animals. It is also present in breast milk, and nursing offspring should be bottle-fed while the mother receives this drug.

Other chemotherapy drugs can cause additive adverse effects when given during doxorubicin therapy. It is not uncommon to have cyclophosphamide given at the same time, but it does tend to increase the toxicities of doxorubicin, especially those affecting the heart.

FLUOROURACIL

This drug, also known as 5-FU or the brand name Adrucil, is most often used in the palliative treatment of cancers in the GI tract and pancreas, or in combination with other drugs for the treatment of mammary cancer. It may also be injected directly into tumor tissue or used topically to treat certain skin tumors. It is used in dogs and horses but should never be given to cats because of the risk of fatal neurotoxicity.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

This drug can suppress the bone marrow, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). It may also cause GI toxicity, usually seen as diarrhea, ulceration or sloughing of the GI lining and stomatitis (painful ulceration and/or soreness of the mucosal membranes in the mouth and GI tract) and neurotoxic effects (evidenced by seizures).

The drug causes birth defects and its use in pregnant animals is not recommended. It is not known if it is secreted in breast milk, so nursing offspring should be bottle-fed with milk replacement while the mother is being treated.

A drug called leucovorin can increase GI toxicity if given at the same time as fluorouracil.

HYDROXYUREA

This drug is used to treat leukemias and a blood condition called *polycythemia vera*.

Storage

The drug is available as capsules that should be stored at room temperature in a child-resistant capped container.

Handling of the Drug and Waste Products

This drug should never be handled by pregnant women. This drug can be absorbed through skin contact and therefore should always be handled while wearing protective gloves. After removing gloves, wash your hands with soap and water. Anytime skin contact occurs, the area should be washed well immediately with soap and water.

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

The GI tract is often a site of adverse effects, including loss of appetite, vomiting, diarrhea, and stomatitis (raw or sore areas of mucous membranes in the mouth). Other effects include loss of the nails and hair as well as painful urination. Bone marrow suppression may occur and is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Fibrotic changes in the lungs have also been observed. In cats receiving over 500-mg doses, a blood disorder called *methemoglobinemia* has occurred.

Hydroxyurea causes birth defects and is secreted in breast milk and is not recommended for use in pregnant animals or in lactating animals.

Other drugs known to depress bone marrow production can have additive effects if given with this drug. Such drugs include other anti-neoplastic drugs, chloramphenicol, flucytosine, amphotericin B, and colchicine.

L-ASPARAGINASE

This drug is an enzyme, sometimes referred to by the brand name, Elspar. It is used to treat lymphoid malignancies and is given by intramuscular or subcutaneous injection.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

A major side effect of L-asparaginase is due to hypersensitivity reactions, which may be characterized by vomiting, diarrhea, urticaria (hives), itching, shortness of breath or painful breathing, restlessness, lowered blood pressure, and collapse. These effects become more likely as the patient receives subsequent doses or if the drug is given intravenously. Most doctors pre-medicate with diphenhydramine (an antihistamine) to counter this type of reaction. The other main adverse effect involves development of pancreatitis or other GI problems and a decrease in protein levels. Liver toxicity or defects in clotting of blood may occur. Large doses have been associated with altered insulin synthesis, leading to increased blood glucose levels. Bone marrow is not generally affected, but lowered white blood cell counts have been observed. L-Asparaginase should not be used in patients with pancreatitis or a history of pancreatitis and should be used with caution in animals with preexisting liver, kidney, GI, blood, or central nervous system dysfunctions.

No studies in animals have found fetal abnormalities when the mother is treated with the drug, but it is still not recommended to be given to pregnant animals.

L-Asparaginase can reduce the effectiveness of methotrexate against tumors until the body's asparagine levels return to normal.

LOMUSTINE

Lomustine is known by the brand name CeeNU as well as by CCNU (an abbreviation of the chemical name). It is used to treat cancers of the central nervous system as well as mast cell tumors, and as a rescue agent against lymphoma.

Storage

The drug is available as capsules that should be stored at room temperature in a child-resistant capped container.

Handling of the Drug and Waste Products

This drug should never be handled by pregnant women. This drug can be absorbed through skin contact and therefore should always be handled while wearing protective gloves. Capsules should not be opened. After removing gloves, wash your hands with soap and water. Anytime skin contact occurs, the area should be washed immediately with soap and water.

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Side Effects and Drug Interactions

Loss of appetite, vomiting, diarrhea, and stomatitis (mucosal changes in the mouth leading to pain and inflammation) may occur after administration of lomustine. Other adverse effects may include loss of hair, loss of the outer layer of cells covering the cornea, and, rarely, liver or kidney toxicity and infiltrates or fibrosis of the lungs. The most serious side effects are those affecting the liver and bone marrow suppression. The latter is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Previous chemotherapy or radiation therapy can increase susceptibility of patients to the side effects and toxicities of lomustine.

Lomustine causes birth defects in laboratory animals, and its use is not recommended in pregnant animals. Lomustine and its metabolites are excreted in milk; therefore lactating animals should not be allowed to nurse their offspring during treatment.

Other drugs that suppress the bone marrow, such as chemotherapeutic drugs, chloramphenicol, flucytosine, amphotericin B, or colchicine, can be additive to the effect of lomustine on the bone marrow. Other drugs that suppress the immune system, such as azathioprine, cyclophosphamide, or corticosteroids (such as prednisone), can increase the patient's susceptibility to infection. Use of vaccines made from live virus cultures should be used with caution or not at all in animals being treated with lomustine.

MECHLORETHAMINE

The brand name of this drug is Mustargen, and it is administered intravenously. It is used for certain kinds of cancers and as part of a multi-drug regimen in some recurrences of cancer.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Reactions and Drug Interactions

Bone marrow depression and nausea and vomiting are the most common side effects with therapy, and the severity of these may be therapy limiting. Bone marrow effects are characterized by low platelet counts (possibly resulting in increased bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Toxicity affecting hearing may occur with high doses. Other side effects may include hair loss, increased uric acid excretion in the urine, liver toxicity, nervous system pain in the peripheral areas (usually legs), and ulcers in the GI tract. If areas outside a blood vessel are contacted by this drug, sloughing of the tissues will be seen.

This drug causes birth defects in pregnant lab animals, so use in pregnant animals should outweigh the risk to the offspring. It is unknown if it enters maternal milk, but common practice is to wean offspring during treatment to avoid the possibility of toxicity to them.

Drugs such as colchicine, flucytosine, amphotericin B, chloramphenicol, and other cancer chemotherapy drugs can increase the bone marrow suppression seen with this drug. Other drugs that suppress the immune system, such as azathioprine, cyclophosphamide, or corticosteroids (such as prednisone), can increase the patient's susceptibility to infection. Use of vaccines made from live virus cultures should be used with caution or not at all in animals being treated with mechlorethamine.

MELPHALAN

This drug is also known by the brand name Alkeran and is used primarily in the treatment of multiple myeloma. It is given orally. The drug should be dispensed preferably in a glass container with a child-resistant cap and should be stored in a refrigerator.

Handling of the Drug and Waste Products

This drug should not be handled by pregnant women at all. This drug can be absorbed through skin contact and therefore should always be handled while wearing protective gloves. After removing gloves, wash your hands with soap and water. Any time skin contact occurs, the area should be washed immediately with soap and water.

Because of the potential for absorption of the drug or hazardous metabolites via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Vomiting, diarrhea, and loss of appetite may be noted as well as the more serious side effects of pulmonary infiltrates and fibrosis. The most serious adverse effect is bone marrow suppression, which is characterized by low platelet counts (possibly resulting in increasing bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others.

Similar drugs have been known to cause birth defects, so consideration of its use in pregnancy should compare the relative benefits of treatment against the risks to the fetus. Melphalan can also suppress the function of reproductive organs. Nursing offspring should be weaned while the mother is treated, although it is not known if it enters the breast milk.

Drugs such as colchicine, flucytosine, amphotericin B, chloramphenicol, and other cancer chemotherapy drugs can increase the bone marrow suppression seen with melphalan. Other drugs that suppress the immune system, such as azathioprine, cyclophosphamide, or corticosteroids (such as prednisone), can increase the patient's susceptibility to infection. Use of vaccines made from live virus cultures should be used with caution or not at all in animals being treated with melphalan. There have also been reports (in humans) that concurrent use of cyclosporine A with melphalan can increase its toxicity to the kidneys.

METHOTREXATE

This drug is used to treat lymphomas and some solid tumors in dogs.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Reactions and Drug Interactions

GI side effects such as nausea, vomiting, and diarrhea are common. Higher doses may also cause listlessness, ulceration in the GI tract, sloughing of mucous membranes and stomatitis (mucosal changes in the mouth leading to pain and inflammation), liver toxicity, death of tissues in the kidney tubules, loss of hair and skin pigmentation, and pulmonary infiltrates, and fibrosis. If given by intrathecal route (in the spinal fluid), toxicity in the central nervous system, characterized by encephalopathy, may occur.

Methotrexate may cause birth defects and be toxic to the embryo. It can also affect production of sperm in male animals. Studies in humans, lab animals, and dogs and cats have varying conclusions as to risks during pregnancy, so generally the benefit of treatment should be greater than the risk to the embryo/fetus when it is used in pregnant animals. Methotrexate is excreted in breast milk, and offspring should be weaned while the mother is treated with the drug.

Drugs that are highly protein bound (such as salicylates, sulfa antibiotics, phenytoin, phenylbutazone, oral anticoagulants [e.g., warfarin], tetracycline and chloramphenicol) given at the same time as methotrexate may cause increased blood levels of either or both drugs. Because of severe GI toxicities in humans, it is recommended that concurrent use of methotrexate and nonsteroidal antiinflammatory agents (e.g., carprofen [Rimadyl]) be avoided. The drug pyrimethamine acts similarly to methotrexate and can increase its toxic effects.

MITOXANTRONE

This drug is sometimes referred to by the trade name Novantrone. The drug is administered by IV injection and is used to treat a variety of cancer types.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Excretion can occur for longer than 1 week; thus these precautions should be taken for a minimum of 48 hours after the last dose is administered and longer if feasible. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

The following side effects are usually dose dependent and will decrease if the dose is decreased: vomiting, loss of appetite and diarrhea, and bone marrow suppression (which may result in a severe infection called *sepsis*). Bone marrow suppression is characterized by low platelet counts (possibly resulting in increased bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. Lethargy may also be noted and the drug is associated with seizures on rare occasion in cats. Cats will tend to lose their whiskers and older dogs may have loss of white hair on the muzzle after receiving this drug. Other uncommon side effects seen in humans that may also be seen in dogs include inflammation of the linings of the eyes, jaundice, kidney failure, seizures, and allergic reactions. If the drug is administered outside a blood vessel, severe tissue damage may occur. A blue-green tint may be noted in the sclera of the eyes or the urine during therapy.

In humans, this drug is classified as one without severe risk to the fetus, but benefits of therapy should outweigh possible risks to the fetus when used in pregnant animals. It is excreted significantly in breast milk, and offspring should be weaned from the mother during her treatment with mitoxantrone.

Drugs such as colchicine, flucytosine, amphotericin B, chloramphenicol, and other cancer chemotherapy drugs can increase the bone marrow suppression seen with mitoxantrone. Other drugs that suppress the immune system, such as azathioprine, cyclophosphamide, or corticosteroids (such as prednisone), can increase the patient's susceptibility to infection. Use of vaccines made from live virus cultures should be used with caution or not at all in animals being treated with mitoxantrone. In humans, an increase in bone marrow suppression has been seen when mitoxantrone and sulfamethoxazole/trimethoprim (an antibiotic) are given at the same time.

Risks of cardiac toxicity may be increased in animals previously treated with doxorubicin or radiation.

PROCARBAZINE

This drug is used as part of a multi-drug therapy against lymphoma recurrences and to treat GME (a neurologic disorder) in dogs, as it enters the central nervous system.

Handling of the Drug and Waste Products

This drug should not be handled by pregnant women at all. This drug can be absorbed through skin contact and therefore should always be handled while wearing protective gloves. After removing gloves, wash your hands with soap and water. Any time skin contact occurs, the area should be washed immediately with soap and water.

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions:

Nausea, vomiting, and toxicity of the liver have been noted. Suppression of the bone marrow with associated lowered white blood cell counts and platelet counts also occurs. These may be signaled by an increased incidence of bleeding or unusual bruising and increased susceptibility to infections. When used with other chemo agents, these GI and bone marrow effects may be enhanced. Effects on the central nervous system including drowsiness or agitation may be noted. Nervous system changes in the periphery of the body may occur and may appear as a loss of tendon reflexes, unusual sensations in the extremities, or muscle pain.

Procarbazine causes birth defects; therefore, its use in pregnant animals should be weighed against fetal risk. Although it is not known if it enters maternal milk, it is recommended that offspring be given milk replacement during treatment of the mother.

Because of the increased incidence of depression of the central nervous system, other drugs that depress the CNS should be used with extreme caution. These include phenobarbital, many analgesics, antihistamines, and drugs in a class called phenothiazines (which may be prescribed for nausea and vomiting). Coma and death have been associated with the use of procarbazine and opiate drugs (such as morphine and codeine and their derivatives). Procarbazine can also react with drugs in the tricyclic antidepressant family (amitriptyline, doxepin, etc.) and phenylpropanolamine (commonly used for urinary leakage or incontinence). Foods containing cheese and yogurt can alter an enzyme system affected by procarbazine and should be avoided because of potential subsequent effects on blood pressure.

STREPTOZOCIN

This drug is also referred to as streptozotocin or by the trade name Zanosar. The drug is administered by slow intravenous infusion and is used primarily to treat insulinoma in dogs.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Severe renal toxicity is of major concern, and making sure the patient receives adequate IV fluids before, during, and after therapy is very important. Routine blood and urine tests are essential in monitoring these effects. Nausea and vomiting occur often and may be severe and long lasting, although anti-emetic drugs may be used to prevent this. Mild suppression of the bone marrow may occur, as well as increases in liver enzymes. If the drug is given outside a blood vessel, severe tissue reaction, including death of the tissues around the site, may occur.

This drug causes birth defects and should be avoided in pregnant animals unless the benefits of therapy outweigh the risk to the fetus. It is not known if it is excreted in breast milk, but puppies should be fed replacement formula while the mother receives the drug.

Drugs that have toxic effects on the kidney (such as aminoglycoside antibiotics, amphotericin B, and cisplatin) can cause added effects when given with streptozocin. It can also prolong the half-life of another cancer drug, doxorubicin, so dosage adjustments are needed if administered concurrently. Use with other drugs that suppress the bone marrow, such as flucytosine, chloramphenicol, colchicine, and amphotericin B, may cause additive effects on the bone marrow.

VINBLASTINE

Vinblastine, also known by the trade name Velban, is given intravenously and is used to treat a variety of tumors in dogs and occasionally cats, including mast cell tumors and lymphoma.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Vinblastine can cause vomiting and nausea, as well as bone marrow suppression, which is characterized by low platelet counts (possibly resulting in increased bruising or bleeding) and a lowering of certain white blood cells called *neutrophils* (which increases susceptibility to infections). Routine blood work is essential to monitor these effects as well as others. The effects on neutrophils often cause prolonged intervals between treatments while waiting for the bone marrow to recover and neutrophil counts to rise. At higher dosages, vinblastine can cause peripheral neurotoxic effects (such as peripheral pain and loss of reflexes). It has also been known to cause constipation, hair loss, stomatitis (mucosal changes in the mouth and GI tract resulting in ulcerations and raw areas), jaw and muscle pain, ileus (intestinal stasis), and loss of deep tendon reflexes. Vinblastine can cause inappropriate secretion of anti-diuretic hormone, which can lead to electrolyte changes in the body. In cats, neurotoxicities can cause constipation and paralytic ileus, which then aggravates the loss of appetite that may occur. Cats can also experience other nervous system effects including demyelination of nerves (causing loss of motor skills). If the drug is injected outside a blood vessel, tissue damage with associated inflammation and swelling may occur.

It is believed (although not proven) that vinblastine can cause fetal damage and therefore the relative benefits of treatment should outweigh the potential fetal risks. Because it is unknown if it is excreted in milk, it is recommended that offspring be given milk replacement while the mother is treated with vinblastine.

Drugs such as cyclosporin A, ketoconazole, verapamil, and phenothiazines (a class of drugs sometimes used to treat nausea and vomiting) may increase the toxicity of vinblastine if given at the same time.

VINCRIStINE

This drug is also known by the trade name Oncovin. It is used to treat a variety of cancers including lymphoma, hemangiosarcoma, and transmissible venereal tumor.

Handling of Waste Products After Administration

Because of the potential for absorption of the drug or its hazardous metabolites through the skin via contact with urine, feces, saliva, vomit, etc., you should wear gloves to clean these up. Washable items coming in contact with these should be handled wearing gloves (and a protective gown if needed) and then washed twice. Use these precautions for a minimum of 48 hours after the last dose is administered. Pregnant women should never handle waste products.

Adverse Effects and Drug Interactions

Vincristine generally causes less bone marrow suppression than many antineoplastic drugs; thus, only mild decreases in white blood cell counts are anticipated. It does, however, cause peripheral neuropathies that can include proprioception deficits (not sensing the body's relative position to other things), spinal hyporeflexia, and paralytic ileus (intestinal stasis) with resulting constipation. Any sign of neurologic toxicity should bring a halt to treatment, since permanent and severe generalized motor weakness may occur. In cats, paralytic ileus and its resulting constipation may aggravate a loss of appetite. Cats can also experience other nervous system effects including demyelination of nerves (causing loss of motor skills). In humans, vincristine has been known to cause mild sensory impairment and peripheral paresthesias (unusual sensations in the extremities), and this may also occur in animals. Vincristine can also cause an increase in the platelet count, but some of these platelets may have impaired function. Hair loss, stomatitis (mucosal changes in the mouth and GI tract resulting in ulcerations and raw areas), jaw and muscle pain, and seizures may also occur, as can the syndrome of inappropriate secretion of anti-diuretic hormone (SIADH), which can lead to electrolyte imbalances.

It is believed (although not proven) that vincristine can cause fetal damage, and therefore the relative benefits of treatment should outweigh the potential fetal risks. Because it is unknown if it is excreted in milk, it is recommended that offspring be given milk replacement while the mother is treated with vincristine.

If given with L-asparaginase, additional neurotoxicities may occur. This may be lessened if the L-asparaginase is given *after* the vincristine. Drugs such as cyclosporin A, ketoconazole, verapamil, and phenothiazines (a class of drugs sometimes used to treat nausea and vomiting) may increase the toxicity of vincristine if given concurrently.

References

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