



## **Ettinger: Textbook of Veterinary Internal Medicine, 7th Edition**

### **Chemotherapy**

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#### **What is chemotherapy?**

Chemotherapy works by damaging rapidly growing cells. Cancer cells are rapidly growing and often cannot repair the damage caused by chemotherapy drugs. Side effects, when they occur, are a result of the chemotherapy contacting normal rapidly growing cells within the body, such as the bone marrow, which continually produces blood cells, and the lining cells in the intestinal tract. As a result, two common side effects of chemotherapy are low white blood cell and platelet counts, as well as diarrhea, vomiting, and loss of appetite. Pets rarely lose their hair as human cancer patients do, because they have fur that does not grow all the time, rather than hair that grows continually. The exceptions to this rule are whiskers on kittens and dog breeds that need to be clipped, such as terriers and sheepdogs.

Some of the most commonly used chemotherapy drugs are the following:

- Vincristine - a liquid given quickly, directly into a vein
- L-asparaginase - a liquid given subcutaneously (under the skin)
- Cyclophosphamide - injectable or pill (wear latex gloves when administering)
- Doxorubicin - a liquid given slowly (over 15 to 20 minutes) into a vein
- Prednisone - a pill, to be given at home. Read and follow directions carefully.

These drugs are used in combination to treat lymphoma. A combination of drugs is used so that cancer cells are killed by several different means to try to prevent the cells from becoming resistant to the individual drugs. Your pet will not receive all of the drugs each time. Your veterinarian will tell you which drug your pet is to receive on each treatment day and will give you a schedule (protocol) to follow.

#### **What side effects may occur?**

All anticancer medications, or chemotherapy drugs, have the potential to produce adverse side effects. However, due to the lower doses used in pets, the side effects that can occur in pets are usually not as severe as those that occur in humans. It is important to know what the possible side effects of each drug are so that you will know what to expect. As the caregiver, you have an important role in recognizing the side effects, managing them at home whenever possible, and alerting your veterinarian if the side effects persist.

**VINCRISTINE**

1. Skin damage at the injection site - this may occur if any of the drug leaks outside the vein. Signs will include swelling, redness, and/or an open sore. Also, your pet may lick at the leg more than usual.
2. Vomiting and diarrhea - occur infrequently.
3. Anorexia (loss of appetite) - occurs rarely in dogs and more commonly in cats.
4. Constipation - occurs rarely in dogs and more commonly in cats.
5. Lethargy - tiredness, not as much energy as usual.

**L-ASPARAGINASE**

1. Vomiting - occasionally severe vomiting may occur with this drug as a result of the development of pancreatitis (inflammation of the pancreas).
2. Allergic reaction - this is rare, but if it does occur, symptoms usually arise within 15 minutes of administration. Symptoms may include itchy, reddened skin, excessive panting, shaking, fever, and possible collapse.
3. Lethargy - tiredness, not as much energy as usual.

**CYCLOPHOSPHAMIDE**

1. Low white blood cell count - the neutrophil count will drop below normal 5 to 7 days after the drug is given but will usually return to normal by the eighth or ninth day. This should not cause a problem unless the cell count drops too low, and the body cannot fight off infections, causing your pet to get sick. If this happens, his/her symptoms may include a fever, vomiting, diarrhea, and anorexia. Your pet may take antibiotics the first time he/she receives cyclophosphamide.
2. Cystitis - cyclophosphamide can cause a chemical irritation to the bladder that can cause the urine to become bloody (hemorrhagic cystitis) and the bladder to be painful. This is not necessarily an infection, but because infection can cause the same symptoms, it is important to perform a urine culture. Cyclophosphamide-induced cystitis can be prevented by giving cyclophosphamide with a diuretic (furosemide) that causes the animal to drink more frequently, by giving the cyclophosphamide in the morning and by allowing plenty of opportunity for urination during the day.
3. Vomiting and diarrhea - are not typically seen with cyclophosphamide.

**DOXIRUBICIN**

1. Nausea, loss of appetite.
2. Vomiting and diarrhea - this may be seen 2 to 5 days after the treatment, if it occurs. The diarrhea may be bloody.
3. Low white blood cell count - (See cyclophosphamide #1.)
4. Skin damage at the injection site - this may occur if any of the drug leaks outside the vein. Signs will include swelling, redness, and/or an open sore. Also, your pet may lick at the leg more than usual.
5. Heart problems - doxorubicin has a cumulative effect on the heart. In other words, the more an animal receives over time, the greater the chance that that

animal may develop a heart problem. However, this *usually* does not occur below a maximum safe dose. Chemotherapy protocols used in veterinary medicine stay within that dose but some animals have developed heart problems even though they received less than the maximum dose. Some dog breeds are more prone to heart problems, such as Boxers and Dobermans. Your pet's heart may be monitored periodically throughout the treatment.

6. Allergic reaction - this is rare and usually occurs during administration. If a reaction occurs, it is usually because the drug is given too fast; therefore it is given slowly, over 15 to 30 minutes.
7. Lethargy - tiredness, not as much energy as usual.

### **PREDNISONE**

1. Increased thirst - your pet will probably drink more than usual.
2. Increased urination - because your pet drinks more, he/she will urinate more frequently.
3. Increased appetite - your pet may be hungrier.
4. Behavior changes - prednisone can cause a change in behavior, but this is rarely noticeable.
5. Increased panting in dogs

### **How do I manage side effects?**

#### **LOW WHITE BLOOD CELL COUNT**

1. Infections caused by a low white blood cell count are potentially the most serious side effect of chemotherapy. Infections are most likely to occur 5 to 7 days after a drug is given.
2. If your pet shows signs of infection (including lethargy, loss of appetite, vomiting, or any other significant change for your pet) 5 to 7 days after the treatment, take your pet's temperature. Normal is 37.8° C-39.2° C. If the temperature is greater than 39.4° C, or if you cannot take the temperature, you should call your veterinarian immediately. A fever with a low white blood cell count is an emergency, and your pet may need to be admitted to the hospital and receive intravenous fluids and antibiotics.

#### **LETHARGY**

1. Take your pet's temperature. Call your veterinarian if the temperature is greater than 39.4° C.
2. Allow your pet to rest as much as he/she wants. His/her energy level should return to normal within a couple of days.

#### **INCREASED THIRST AND URINATION**

1. Allow your pet to drink as much as he/she wants, and allow ample opportunity for urination.

**ANOREXIA (LOSS OF APPETITE)**

1. Take your pet's temperature. Call your veterinarian if the temperature is greater than 39.4° C.
2. Offer your pet enticing foods such as chicken, ham, and tuna. Try warming the food.
3. Call the veterinarian if the anorexia persists for more than 48 hours.

**VOMITING**

1. Take your pet's temperature. Call your veterinarian if the temperature is greater than 39.4° C.
2. Withhold food and water for 12 hours and then offer your pet small amounts of water. (If your pet just received cyclophosphamide, do **not** withhold water. This could increase the risk of developing hemorrhagic cystitis).
3. If your pet does not vomit after drinking water, offer bland foods such as boiled chicken and rice or chicken baby food. Gradually reintroduce normal diet.
4. Call the hospital if vomiting is severe, accompanied by a fever, or persists longer than 24 hours.

**DIARRHEA**

1. Withhold food for 12 hours. Water is OK.
2. Offer bland, easily digestible foods such as boiled chicken and rice. Gradually reintroduce normal diet. Bismuth liquid can be given to dogs but not to cats - contact your veterinarian for proper dosages.
3. Call your veterinarian if diarrhea persists for more than 48 hours or if it is associated with a fever of greater than 39.4° C.

**CONSTIPATION**

1. Allow and encourage your pet to drink plenty of water.
2. Offer bland, easily digestible food such as boiled chicken and rice or chicken baby food. Gradually introduce normal diet.
3. Call your veterinarian if your pet has not had a bowel movement in more than 36 hours and/or is straining to defecate.

**CYSTITIS/BLOOD IN URINE**

1. Call your veterinarian if your pet has bloody urine. Be sure to tell him/her that your pet has been given cyclophosphamide.
2. Your veterinarian will most likely have you bring your pet in for a urine culture to determine the cause (cyclophosphamide or infection).
3. If the cyclophosphamide is the cause of the bloody urine, it will be stopped and another drug used in place of cyclophosphamide.

**ALLERGIC REACTION**

1. After each dose of L-asparaginase, you should remain at the hospital with your pet for 15 to 20 minutes so that if a reaction does occur, it can be treated.
2. Call the hospital if any symptoms are seen later at home.

**SKIN DAMAGE:**

1. Try to keep your pet from licking the affected area. Your pet may need to have the leg bandaged or wear and Elizabethan collar ("E-collar")