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CANCER TREATMENT

Learning that your pet has a diagnosis of cancer can be overwhelming. We realize that your pet is an important member of your family who deserves the best cancer treatment available. Fortunately, continuous improvements in our knowledge as well as new and evolving methods of treatment give many different treatment options to pets recently diagnosed with cancer. Some cancers may be cured with appropriate treatment. Others, while they may not be curable, can be treated while maintaining a good quality of life. For patients with advanced cancer, treatment may help alleviate symptoms, such as pain, and greatly improve the quality of the pet's remaining life. Together, your oncology team will formulate a treatment plan that fits your treatment goals while keeping your pet's best interest in mind. With this comprehensive approach to treatment and careful attention to quality of life, cancer treatment can be a rewarding and healing experience.

What types of treatment are available?

A tumor biopsy is often required for your veterinary oncologist to give you an accurate assessment regarding tumor type, grade (degree of malignancy) and surgical margins (if the mass has been completely removed). Tumor staging is a process where additional diagnostics may be recommended to determine if there is any tumor spread to other sites in the body (metastasis). After reviewing biopsy and tumor staging results, your veterinary oncologist can discuss various treatment options that are most appropriate for your pet.

Treatment options are categorized into local, systemic, and multimodality therapies. **Local therapy** (surgery, intralesional chemotherapy, cryosurgery, photodynamic therapy and radiation) is best for cancer that is apparently confined to a well-defined area in an accessible site. **Systemic (whole body) treatment** consists of chemotherapy, gene therapy, anti-inflammatory drugs and immunotherapy. These treatments are considered for tumors that are widespread, or for tumors in which there is significant and immediate risk of spread from the initial location. In addition to the above mainstream treatments, **nutrition**

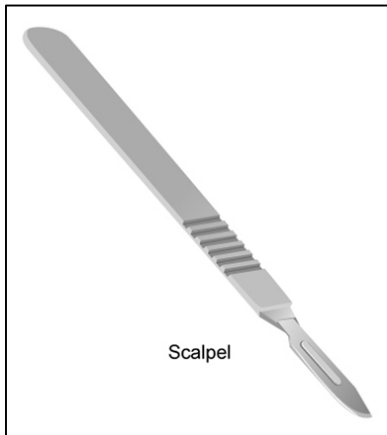


counselling and **Complementary and Alternative Medicine (CAM)** is a holistic approach providing treatments (acupuncture, herbal/botanical medicine, nutraceuticals) designed to treat all aspects of your pet's health. **Multimodality treatment** involves therapies from more than one treatment category (local, systemic, nutrition modifications, CAM), often providing our cancer patients with the best possible outcome and quality of life.

Surgical treatment

Surgery is a common part of cancer treatment in which the pre-operative goal can range from being a curative procedure to palliative (not curative, but improving overall quality of

life). The type and extent of surgery along with possible complications is dependant upon tumor type, location, grade and stage and will be discussed in further detail for individual patients during your consultation. Your family veterinarian can perform some surgeries; however, many cancer surgeries are more complex requiring the expertise of a Board Certified veterinary surgeon.



Benign (non-invasive, non-spreading) tumors in well-defined and accessible areas may be permanently cured by surgical removal. Surgery is often the best treatment for the majority of malignant cancers that have not yet spread (metastasized). For malignant tumors, a wide margin of normal tissue surrounding the cancer is removed to help decrease local recurrence. Palliative surgical procedures may be recommended for pets with advanced cancer to improve quality of life. Post surgical recovery in most pets is rapid (1-2 weeks) and post-surgical pain is controllable with medications.

Small surgical procedures can be done under local anesthesia, however, general anesthesia is required for most surgical procedures. General anesthesia is associated with very small risk in otherwise healthy animals but the risk is greater in animals that are sick or elderly.

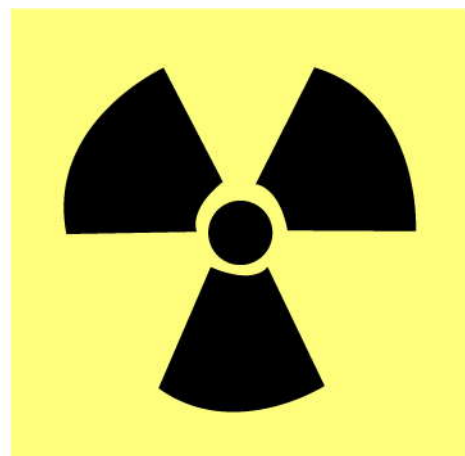
Special forms of surgery

The use of freezing temperatures (cryosurgery) can be used for some types of cancers. Cryosurgery consists of rapidly freezing a tumor using liquid nitrogen and then allowing the tumor to thaw slowly. Usually, two to three freeze-thaw cycles are performed during each treatment. After cryosurgery, the tumor tissue slowly dies over the following two weeks. During this time, redness, an unpleasant odor and appearance and bleeding may occur. Success of this treatment is dependant upon tumor size (less than 1 cm) and invasiveness. Cryosurgery may need to be repeated in 2-3 weeks.

Radiotherapy

Radiation is currently only available at referral veterinary hospitals. The mechanism of action involves the use high energy radiation (similar to x-rays but at a much higher energy level) that is capable of injuring cellular DNA (genetic material). Cells undergoing more frequent cell divisions (multiplying) are the most sensitive to radiation and this is why tumor cells tend to be more susceptible compared to normal tissue. However, normal healthy cells within the radiation field can also be damaged or destroyed by the radiation, particularly actively dividing cells like those of the intestinal lining, skin, bone marrow and immune system. The damage to normal cells is the cause of radiation side effects. The side effects that may occur for your pet secondary to radiation are dependant upon the recommended radiation protocol and the tissue within the radiation field. These potential side effects will be discussed during your consultation.

Radiation therapy is often used in combination with surgery and/or chemotherapy. It may be used before surgery to shrink very large tumors or after surgery to kill cancer cells that may have remained. The goal of treatment often determines the **radiation protocol** (full course vs. palliative) recommended. **Full course radiation** involves the administration of small doses of radiation frequently (Monday through Friday) for 15-22 treatments. This protocol is often recommended for tumors in which the potential for metastasis is low and radiation offers the potential



for long term tumor control (over one year). **Palliative radiation** involves the administration of large doses of radiation infrequently (once to twice a week) for 3-6 treatments. This protocol is often recommended for high-grade tumors that have a high potential for tumor spread or for palliation (pain relief, decreased bleeding, improved function and quality of life).

There are two main ways that radiation treatment is administered; **external beam** and interstitial **brachytherapy**. Most radiation therapy in veterinary oncology is delivered as external beam radiation where radiation is generated by a machine that is directed towards the patient. Brachytherapy involves implanting a radioactive isotope inside the tumor. Although, brachytherapy is less damaging to surrounding tissue compared to external beam therapy, animals treated with radioactive implants do pose an exposure risk to their handlers. The pet therefore has to be kept in a specially constructed compound until the radioactivity is reduced to a safe level. Radiation therapy can only be administered to animals under general anesthesia.

In both types the radiation dose needs to be carefully planned. A CT scan may be recommended for radiation planning. Tumor types that may respond well to radiotherapy, or where radiotherapy can improve quality of remaining life include mast cell tumors, sarcomas (cancer of bone, muscle or various connective tissue), lymphosarcoma, and tumors of the mouth, nose, brain and thyroid.

Systemic chemotherapy

Although we use many of the same chemotherapeutics as those used to treat people with cancer, the side effects in our animal patients are much less severe than is traditionally associated with chemotherapy in people. The reason for lower side effects is that veterinary chemotherapy protocols use lower total doses and less aggressive combinations of drugs than most human chemotherapy protocols. Therefore, most dogs and cats undergoing chemotherapy have a normal quality of life.

In general, chemotherapy agents work by damaging cellular DNA of rapidly dividing cells. Similar to radiation, normal healthy cells can also be damaged or destroyed by chemotherapy, particularly actively dividing cells like those of the intestinal lining, bone marrow and immune system. Resulting side effects such as vomiting, diarrhea, hair loss and lowered resistance to infection can occur. In most cases, these effects can be moderated or eliminated by use of appropriate medications and adjustment of the chemotherapy protocol. Fortunately there are continuous improvements in the drugs available for moderating side effects of chemotherapy. In general, the use of many drugs together (drug cocktail) is less toxic and more likely to benefit the animal than use of a single drug.



Chemotherapy is recommended for treatment of various cancers such as lymphoma, leukemia, mast cell tumors, hemangiosarcoma, osteosarcoma, high grade sarcomas, and high grade carcinomas. It may also be indicated for localized disease if surgery or radiation therapy is not feasible. The aim of chemotherapy varies from complete remission, or prolonging the period of remission to palliative therapy intended to minimize patient discomfort, pain and suffering. Most cancers in veterinary patients will not be permanently cured by chemotherapy. In veterinary medicine chemotherapy protocols have been designed to maximize the

patient's life spans and most importantly their quality of life. These protocols are designed to minimize side effects.

Unfortunately, chemotherapy may not be effective in some patients. Treatment failure can occur because chemotherapy can select for cells resistant to treatment (drug resistance) so a drug may become less effective in subsequent treatment. When this occurs, attempting to use higher doses of the same drugs may result in increased toxicity without an increase in beneficial effects.

Anti-inflammatory drugs

Inflammation-promoting substances called 'prostaglandins' are produced by some tumors. Treatment with non-steroidal anti-inflammatory drugs (NSAIDs) that reduce prostaglandin production can therefore give some clinical relief. This treatment has caused remission of some carcinomas in dogs. It is widely available and inexpensive. Patients have to be monitored for signs of gastrointestinal tract and kidney problems.

Immunotherapy

An animal's immune system may be capable of recognizing cancer cells as abnormal and can respond by stimulating the production of special cells and factors that can destroy those cancer cells. In most cancer patients, however, this immune response is typically weak or absent. This is because cancer cells themselves reduce the ability of the immune system to respond (immunosuppression). Therefore, methods directed at stimulating or enhancing the immune system may be effective as an anti-cancer treatment.

Immunotherapy uses the immune system to kill cancer cells. Various drugs (collectively referred to as 'immunomodulators') can affect the immune system, by either suppressing or enhancing it. A lot of current cancer research is aimed at investigating ways of stimulating the immune system to specifically recognize cancer cells. An example of such treatment involves the use of tumor vaccines which are administered to stimulate the immune system to recognize malignant melanoma cells in dogs. In addition, there are a wide variety of non-specific immunotherapy medications that target the entire immune system as a whole, not necessarily to a specific cancer cell.

Future Prospects for Cancer Treatment

Gene therapy

Gene therapy is the introduction of part of the reproductive code (gene) into a cell. This type of treatment has been used to target certain diseases including infections, inflammatory disorders, and cancer. In order to get the new gene into a cancer cell, the gene needs to be delivered by vectors, which include viruses, vaccines or physically in liposomes. Mechanisms by which gene therapy is able to kill cancer cells include the delivery of "suicide genes" making the tumor commit suicide, activating drugs to kill tumor cells specifically or enhancing an immune system reaction to the tumor. Currently, in animals, this type of therapy is still at the experimental stage.

Photodynamic therapy

Photodynamic therapy uses a photosensitizing drug that enters the tumor. The drug within the tumor is activated by a specific wavelength of light to generate intracellular oxygen and leads to death of cells and loss of blood supply. This type of treatment is useful for superficial and bladder tumors but is not yet widely available.

Angiogenesis modulators

Cancers stimulate new blood vessels to grow. Angiogenesis modulators (or antiangiogenics) are various drugs that reduce this new blood supply and "starve" the cancer. Some non-steroidal anti-inflammatory drugs (see 'Anti-inflammatory drugs' above) are thought to have

this anti-angiogenic effect. Other drugs, including a chronic low dose chemotherapy protocol may also be anti-angiogenic.

Symptomatic and palliative treatment

Many of the above treatments, and others, may be used to palliate (relieve) the effects of the cancer and improve quality of life. The potential side effects of treatment have to be balanced against the improvement achievable and life expectancy.

Special diets are reported to delay cancer progression and some may palliate the clinical effects of cancer or the side effects of treatment.

Drugs that reduce pain and inflammation may also improve the quality of life for your pet. Acupuncture may also be used to control pain or improve energy levels, appetite and quality of life in some patients.

As in humans, our understanding of cancer in dogs and cats is increasing all the time. Survival rates are improving and many animals are alive and well as “cancer survivors”.

In making decisions on the course of action to be undertaken in a specific situation, your veterinary oncologist will help you come to an informed choice that takes into consideration all factors. There are many treatment options available in the treatment of cancer, and there is not one right answer for every pet or family. Your veterinarian will help you weigh the pro's and con's of the various treatment options and will help you come to an informed decision that is right for you and your pet.