

Tumors, Cancer, and Your Westie

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Introduction and Overview

“Your dog has a tumor.” This is one of the most stressful things a Westie owner can ever hear from their veterinarian. For most people, there is an immediate concern about what it is (what kind of tumor), what to do about it (if anything), and what is going to happen to their dog. This chapter discusses tumors (also called “neoplasms” – new cells), how they are detected and further diagnosed, types of therapy, and what to expect if your dog has a tumor. The chapter is not intended to provide comprehensive information about tumors and cancer. The best source of information about tumors in dogs and specifically in your dog is your veterinarian. Veterinarians are extensively trained to understand how tumors develop, the factors that foster their growth, and, most importantly... what to do. Unfortunately, the author of this chapter knows personally about tumors and cancer in dogs and cats, and the toll it takes on owners. His best friend, Fluffer I the Westie succumbed to a tumor of the testis when he was a young boy. Experience is a terrible way to learn some things.



What are tumors (“neoplasms”) and what causes them? All tissues in the body (of dogs and people alike) are made of many cells. Cells in different tissues, such as muscle cells in muscle and kidney cells in kidneys, have different architectures and functions. All of these cells started from a single cell – the fertilized egg - that gave rise to an embryo and eventually to all cells and tissues. Since every cell in every tissue came from one single cell, all cells have the same DNA, organized into genes and chromosomes in the cell nucleus. As a result, all cells are genetically identical.

During the processes of cell growth, duplication, and organization into tissues, the form and function of the cells and tissues evolves into their ‘final’ adult form. This process of cell evolution is called differentiation. Cell growth, replication (making more cells), and differentiation let tiny puppies grow into dynamic adult dogs.

The processes of cell growth, replication, and differentiation occur every day and throughout life. These processes are absolutely critical in repairing damage and replacing worn out tissue components. It is important to realize that the processes of growth and repair are very tightly controlled by genes in the nucleus of every cell. When these processes are working perfectly, cells that can replicate make exact copies of themselves, and other cells ensure that tissues continue to function properly.

Tumors (neoplasms) are groups of abnormal cells that have escaped from the normal controls of cell division, replication, and differentiation. The fundamental ‘thing’ that starts and fuels this out-of-control process is mutation of genes that program and control cells. Mutations (changes in gene structure and function) have an important normal role in evolution, as they provide the mechanisms needed for changes in genes to be incorporated into organisms (and eventually into species). Mutations that favor new characteristics and improve survival become permanent additions to the gene blueprint of cells (“the genome”). Mutations that damage the DNA in genes in the genome and that impair cell survival usually aren’t preserved, as the cells with these profound defects die off before they make more cells.

Some mutations affect critical elements in genes that control cell growth, replication, differentiation, and survival. It is these mutations that give rise to tumors (neoplasms).

Mutations can be caused by many things. Surprisingly, some mutations (favoring abnormal gene control and function) can be inherited. We know that the selective breeding of dogs for the past 200+ years has facilitated the passage of mutations favoring tumor development in some breeds of dogs, including

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Westies. An example of an inherited ‘risk’ for developing tumors is bladder cancer in Scottish and West Highland White Terriers (see *Bladder Cancer in Westies and Scotties*). At some point in the selective breeding of these purebreds, one or more mutations were incorporated into their genome and have been inherited ever since. Another example is lymphoma in Golden Retriever dogs. Based on breed and health club statistics, about 60% of Golden Retrievers will succumb to lymphoma or tumors of the spleen (hemangiosarcoma). As dog breeders and owners, we need to be aware of the presence of breed-associated inherited mutations linked to the development of tumors.

Many mutations are caused by exposure to excessive ionizing radiation (e.g., ultraviolet light, x-rays/gamma rays), chemicals that damage DNA (called chemical mutagens), and some very specialized viruses (called oncogenic viruses). These entities (radiation, chemicals, and viruses) are collectively referred to as carcinogenic agents. They damage DNA and genes, removing critical control elements that regulate cell replication, differentiation and survival. Dogs and people get exposed to these carcinogenic agents in the air, drinking water, in food, and by direct physical contact. Exposure is unavoidable; but our bodies and those of our dogs are very resistant to the effects of the agents, and very, very few exposures ever lead to

mutations and even fewer lead to the uncontrolled growth of cells (tumors). Our bodies simply kill off nearly all mutated cells. Unfortunately, a few survive.

We now know that the formation of tumors begins in individual cells that acquire several mutations (either through inheritance or exposure to carcinogenic agents). These mutated cells make more mutated cells...and more mutated cells, creating a tumor. This process of evolving from one uncontrolled cell to a clinically important tumor takes months to years. So, by the time we owners see tumors in or on our dogs, they have been developing for a long time.

Benign tumors and malignant tumors (“cancer”): By examining small samples microscopically, tumors are classified by their growth patterns and cell architecture (see *Detecting and Diagnosing Tumors*) as being either benign or malignant. Benign tumors, such as warts (officially known as “cutaneous papillomas”), are characterized by excessive cell growth in a local area. Many benign neoplasms form discrete lumps and bumps. These are frequently treated by surgical removal, local chemotherapy, radiation, cryosurgery (freezing), or a combination of these treatments. Benign tumors usually respond very well to treatment, being well controlled for long periods of time or cured completely.



Figure 1 - Some skin tumors may be hidden beneath the dog's hair.

Malignant tumors are a different story. Malignant tumors are those types of neoplasms that are officially “cancer”. Malignant tumors start as local uncontrolled cell clusters, but may spread (infiltrate) into the tissue around them. Malignant neoplasms may also spread to distant sites, a process called “metastasis”, by way of the blood stream and lymphatic channels. Sometimes, veterinarians will use the terms “carcinoma” or “sarcoma” when discussing malignant neoplasms. These terms help define the type of tissue that the cancer originates from and relates to terminology that pathologists use when describing what they see in the tissue samples (see *Detecting and Diagnosing Tumors*).

Malignant neoplasms are difficult to control or eliminate in dogs and people. One reason for this is that malignant cells tend to infiltrate normal tissues around the site of tumor growth early in the life span of the tumor. Because malignant neoplasms infiltrate tissue, they are more difficult to remove with surgery or radiation therapy. As a result, malignant neoplasms frequently require extensive surgical resection, followed by additional radiation and chemotherapy to control tumor growth. Unfortunately, many malignant tumors are identified after they have grown for a while, and they may be large, highly infiltrative, or have already sent clusters of

tumor cells to distant sites, like the lung, liver, brain, or bones (tumor metastases). When these malignant tumors are spread, they are more difficult, if not impossible, to get under control and to cure.

Detecting and Diagnosing Tumors

Most tumors are detected by dog owners, not veterinarians! You are your Westie’s best friend and spend the most time with your dog. It is very common for owners to be the first to detect “lumps and bumps” that appear on the skin, simply by seeing them, or feeling them as they pet or groom their dog. So, Strategy #1 in fighting tumors – regularly (every day) examine all the parts of your dog you can see and feel. Early detection of tumors is one of the best ways to effectively prevent serious problems – since small tumors are relatively easy to treat and have rarely spread extensively in tissue around them or to distant sites.

Regular examination should start when dogs are very young and continue throughout their life. A great time to start examining your dog is when it is three-weeks old. (see *Figure 2* at left, courtesy of Bebe Pinter and Kay McGuire, DVM, MS). This activity helps you bond with your dog and helps the dog get used to being examined; your veterinarian will thank you for doing this. Most importantly, this will help you identify abnormalities like swellings/lumps and potentially painful spots that are often hard to see because they are covered by hair or they are on parts of the dog (the belly, for example) that may not be easy to see. A good routine is to start by patting and stroking the head and face and then moving your hands down the entire body. Palpation (i.e., careful, systematic touching) should extend to the neck, under the legs, the belly and the groin. Your examination should include looking at the eyes, eyelids, ears and into the mouth. Being thorough and starting early in life are keys to success, as dogs get used to the examination as part of their daily routine.

Male dogs need to get used to examination of their penis and testicles; testicular tumors can cause asymmetrical (uneven) swelling of the testicles, generally in older dogs. The absence of a testicle in the scrotal sac (“cryptorchidism”), after dogs have reached 6-12 weeks old, should trigger a visit to the veterinarian. Testicles that are retained in the inguinal canal or abdomen may develop tumors later in the dog’s life. Breeders need to be especially diligent about regular evaluation of the testes of their male breeding dogs, since testicular tumors are most common in older male dogs. Neutering at a young age effectively eliminates the chance that a male dog will develop testicular tumors.



Figure 2 - A great time to start examining your dog is when it is three-weeks old. (Photo courtesy of Bebe Pinter and Kay McGuire, DVM, MS).

The careful examination and palpation of the mammary glands is very important, as tumors of the mammary glands are common in all breeds of dogs. Most of these tumors start as small lumps, perhaps the size of a pea, but can grow steadily larger. It is not uncommon for some dogs to have several small lumps develop in the mammary glands over time. Many mammary gland tumors in dogs are benign and can be easily controlled with surgery.

If you find a lump....see your veterinarian! There are many, many things that can cause lumps, bumps, and other abnormalities on the skin, eyes, ears, and “outside parts”. Lumps that are scabbed over or which bleed easily, as an example, could be anything ranging from a localized skin infection to a tumor. You and your veterinarian then will determine the next steps to take. If the clinical diagnosis is that the mass may be a tumor, a small sample, called a tissue biopsy, may be obtained. Usually this procedure is performed with the dog under general anesthesia and by surgical incision so the sample can be evaluated by a pathologist. The piece of tissue is first preserved in a solution of formaldehyde and then processed to produce a thin piece of stained tissue on a glass microscope slide. It generally takes 1-2 weeks to process and examine a surgical biopsy. This slide is evaluated by a pathologist trained to recognize the abnormalities in cell size and architecture that differentiates normal cells from tumor cells.

When pathologists examine a biopsy, in most cases they are able to determine if a tumor is benign or malignant. If the veterinarian did a surgical procedure aimed at removing the entire tumor, the pathologist will evaluate the edges of the tissue – the boundary between normal and abnormal tissue (called “the margins”) – to see if the tumor has been completely removed. In most cases, surgery to treat tumors (see *Treating Tumors*) is designed to remove all tumor cells, as remaining tumor cells may regrow.

At times, your veterinarian may decide to use other methods to make a diagnosis. One technique, called needle biopsy, involves anesthetizing the mass and surrounding skin with a local anesthetic, and puncturing it with a needle. Fluid and cells drawn out of the lump are examined by the veterinarian or a pathologist to see if changes in cell size and shape indicate a tumor may be present.

While tumors on the outside of the body (skin, mammary glands, testes, eyes, eyelids, ears) can be easily detected by regular and repetitive examination, some tumors grow in tissues inside the body. These tumors are not easily detectable but may produce some signs that your dog needs further evaluation. Some clinical signs that may trigger further evaluation include:

- Unexplained loss of weight and changes in eating habits, including loss of appetite

- Unusual discharges from body orifices including ears, mouth, reproductive tract, or digestive tract
- Unusual behavior, including lethargy or sleepiness that is not normal for your dog
- Unusual weakness or lameness
- Pale gums
- Other changes in the normal routine of your dog that make you think “Something is not right”. In fact, this is how I detected tumors in several of my dogs and cats. My dog Heidi, age 11, suddenly collapsed because a tumor in her abdomen was making hormones that interfered with blood calcium concentrations.

When you suspect that “something is not right”, your veterinarian will conduct a thorough physical evaluation of your dog, very likely will take blood samples to evaluate general health (hematology and clinical chemistry evaluation) and potentially detect abnormalities, and may recommend radiographs (x-rays) to examine your dog’s internal organs. In many cases, this more thorough evaluation will help determine if a tumor is present, where it is located, and which tissues are involved. This process will help you and your veterinarian determine the best course of treatment. If an internal mass is detected, it is common for veterinarians to recommend that a biopsy sample be collected. This sample will be examined to determine the type of tumor present and, based on its characteristics and what is known about tumors of this type, to predict how the tumor will behave (grow and potentially spread) and which therapies might be effective.

Common Tumor Problems in Westies

A couple of generalizations about tumors in dogs will help put things in perspective:

- Tumors are more common in middle age (over 5 years old) and older aged dogs, than in young dogs.
- Most tumors develop slowly and the cause of the tumors is never known; owners need to know they very likely could not have prevented the development of a tumor, except...
- Early neutering of male dogs will eliminate development of testicular tumors and may affect development of prostate problems.
- Spaying of female dogs less than one year of age will decrease the incidence of mammary gland tumors as the dog ages. Early spaying eliminates the possibility of developing both ovarian and uterine tumors, although neither of these types of tumors are common in dogs.
- Regular examinations by owners and veterinarians help detect tumors at earlier stages, when they are more likely to be controlled with surgery, radiation, and chemotherapy – the standard types of treatment.
- Skin tumors are common in all dogs and are usually and effectively treated with surgical removal.

Most Common Types of Tumors

Blood/Lymph Tissue 22.6%

Urinary 17.7%

Skin 14.5%

- Malignant tumors are more difficult to treat and control, are more likely to have poor outcomes, and can be costly to manage if chemotherapy and/or radiation therapy is used.

Tumors in Westies by site of occurrence (62 animals total; number in parentheses is the number of neoplasms)

- Digestive System (7)
- Endocrine System (1)
- Epithelial and Melanocytic Tumors of the Skin (9)
- Hematopoietic/lymphoreticular System, including Malignant Lymphoma (14)
- Mesenchymal Tumors of Skin & Connective Tissue (3)
- Mammary Glands (5)
- Male Genital System (2)
- Nervous System or Eyes (4)
- Respiratory System (6)
- Urinary System (11)

The most common types of neoplasms, based on percentages were: hematopoietic/lymphoreticular system neoplasms including malignant lymphoma ($14/62 = 22.6\%$) and urinary system neoplasms ($11/62 = 17.7\%$).

While the information in this Veterinary Cancer Registry database search is very useful for identifying overall trends in the incidence of neoplasms in dogs, it has limitations. First, only a small number of total cases are submitted for entry into the database, and it is very likely that there are many more dogs with tumors whose records are not submitted for inclusion. Second, only cases in which there has been a biopsy confirmation of the tumor type are included. Many dogs with masses may not be biopsied and their information may not end up in the database. Third, it is very hard to tell if the numbers presented in the Veterinary Cancer Registry database represent all of the dogs at risk. There is no way to know how many Westies (or Scotties, or Cairns, or dogs of mixed heritage) are in the United States. As a result, we can only make rough estimates of 'dogs at risk' for developing neoplasms.

The work of breed clubs like the WFA in conducting surveys of health problems in specific breeds is one of the best ways to know how many Westies (or Scotties, or Cairns, or dogs of mixed heritage) live in the United States. Data from these organizations can help provide rough estimates of 'dogs at risk' for developing neoplasms and is a great help in making more accurate data available.

Bladder Cancer in Westies and Scotties

One type of cancer that is of very serious concern to owners of Westies and Scotties is bladder cancer. The medical designation of this type of malignant neoplasm is "transitional cell carcinoma" of the urinary bladder. Bladder cancer can occur in any dog breed, but is more common in Shetland Sheepdogs, Scottish Terriers and Westies. The median age of occurrence for dogs is around 8 years old.

There are several excellent websites which discuss bladder cancer in dogs, how this tumor is diagnosed and how it is treated. While owners may wish to "Google" this subject, a more comprehensive, scientific literature review and list of references are found at the end of this section.

A brief summary of important aspects of this disease will help to alert Westie owners that their dog may have a problem.

Bladder cancer develops from cells that line the urinary bladder and the kidney. There appear to be several factors that influence whether or not this neoplasm will develop. In dogs, the genome appears to play a major role, as some breeds (the short legged Scots breeds like Westies and Scotties) appear to have a higher incidence per capita than other breeds of dogs (see below). This increased breed incidence suggests that during the development of the breed, certain mutations in the genome were acquired and linked to desirable breed characteristics. It is very likely that several mutations may be present and research scientists are actively looking for them, in order to see what is causing cancer to develop. Remember, not every dog will inherit mutations that can lead to the development of cancer, and it