DIAGNOSIS OF CANCER IN VETERINARY PRACTICE

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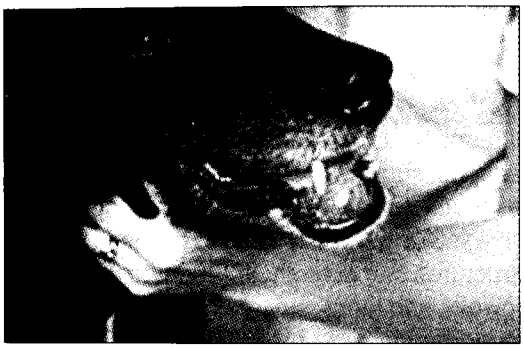
The diagnosis of cancer is not always as straightforward as it would seem. We are all familiar with people who have shown clinical signs for months before their doctors finally discovered cancer somewhere in their bodies. Several methods may be used to diagnose neoplastic disease in animals.

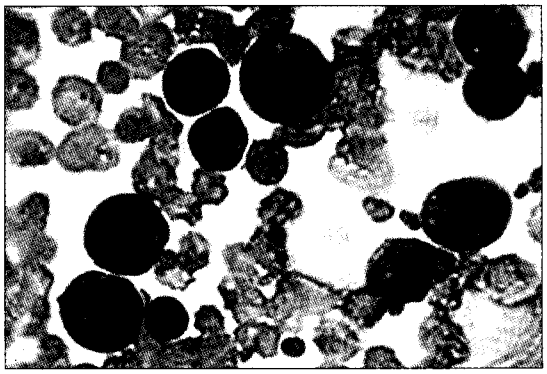
Figure 1: A oral fibrosarcoma on the lower jaw of an elderly labrador retriever.



Physical Examination - Sometimes a ***tumor*** is readily seen on the animal's skin or in its mouth, or the veterinarian may be able to palpate a tumor in the pet's abdomen (fig.1).

Blood and Urine Testing - In some tumors, cancer cells circulate in the blood. ***Leukemia*** is a cancer of the ***bone marrow***, in which the tumor cells leave the marrow cavity at the center of the bone and move into the blood stream. These cells may often be seen on a blood smear as part of a procedure called a CBC (***complete blood count***) (fig.2).

Figure 2: Cancer cells on a blood smear from an animal with leukemia.A tumor of antibody-producing cells, plasma cell myeloma, may produce an elevation of the plasma protein level. Clues may be found to a cancer's presence or location in other blood tests as well; for example, elevation of liver enzymes and plasma bilirubin in the ***biochemical panel*** may suggest that a tumor is present in the liver, impeding circulation of bile. A urinalysis may reveal



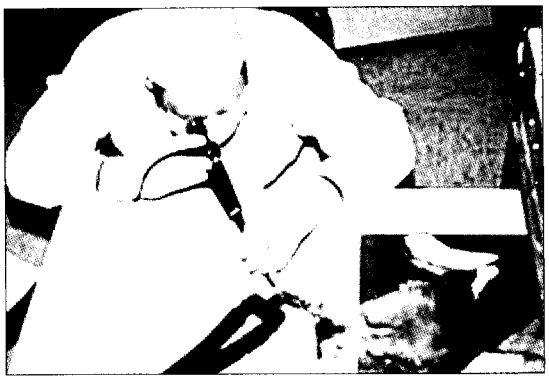
blood but no evidence of infection, suggesting the possibility of a tumor in the bladder. Since routine blood testing is so useful to screen for cancer as well as other illnesses, most veterinarians recommend that a CBC, biochemical panel, and urinalysis be performed once a year on middle-aged or older pets.

Endoscopy, Thoracoscopy, or Laparoscopy - The use of fiber-optic endoscopes has become very common in veterinary medicine over the last two decades (fig.3).

Figure 3: An examination of the nasal cavity of a dog with a fiber-optic endoscope.

With these instruments, tumors in the esophagus, stomach, bronchus, lung, liver, spleen, and other organs may be visualized and biopsied without a large surgical incision.

Radiography - Both regular ***x-rays*** and contrast techniques (such as a barium series, in which the organ is well-defined by a white, "radio-opaque" contrast agent injected into or swallowed by the



animal) may be used to demonstrate tumors of the lung, ***gastrointestinal tract***, bladder, prostate, and other internal organs (fig.4). Sometimes, a radiograph may be "pathognomonic" (completely typical) for a particular type of tumor, as in the case of skeletal ***osteosarcoma***.

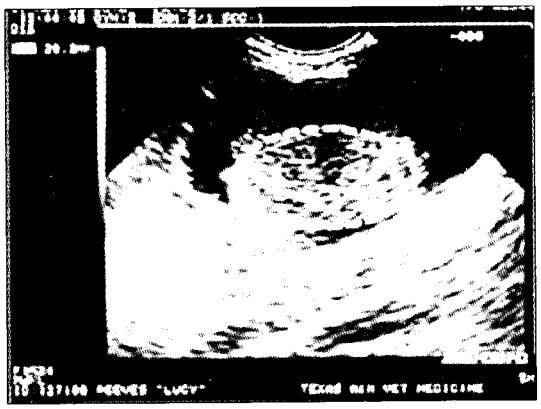
Figure 4: A small bladder mass is outlined by a contrast study.

Multiple nodular densities in the lung would suggest blood-borne ***metastasis*** (see; metastasis) of a ***malignant*** tumor. However, other diagnoses may still need to be ruled out by biopsy of these lesions if clinical and historical findings do not fit, even when radiograph appear to be clearly diagnostic.

Ultrasound Examination - With "real-time" ultrasound scanners, a continuous picture of internal organs can be depicted on a monitor screen. Very high frequency sound waves of between 3.5 to 7.0 megahertz (i.e., 3.5 to 7 million cycles per second) are generally used for this purpose. They are emitted from a transducer which is placed in contact with the structure to be scanned; the transducer is moved around to "look at" the interior structures.

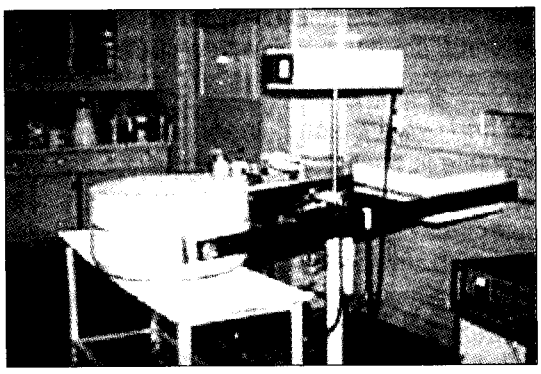
Figure 5: A bladder mass is identified by "real -time" ultrasound.

Repetitive arrays of ultrasound beams scan the



organs in thin slices and are reflected back onto the same transducer. The information obtained from different reflections is recomposed back into a picture on the monitor screen (fig.5). Abdominal ultrasound scans are performed for a variety of reasons, such as to evaluate palpable masses or to check for metastasis to liver, spleen, etc. Ultrasound generally cannot be used to look at structures that contain air (such as the stomach, bowels, and lung), since air prevents transfer of sound waves.

Nuclear Medicine -

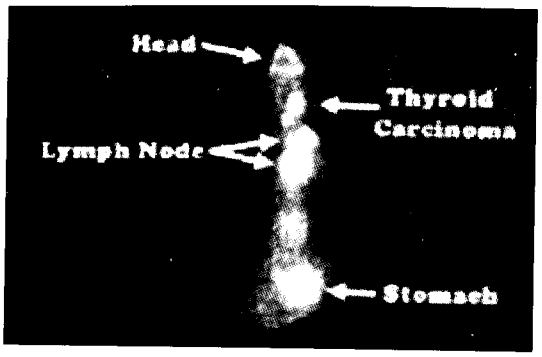


Scans of the liver, thyroid, lung, spleen, kidney, and bone are used commonly in veterinary and human medicine to diagnose cancer and to determine whether it has spread (fig.6)

Figure 6: Nuclear medicine gamma camera.

. Radioisotopes with short half-lives are used, and are given either ***orally*** or by ***injection***. Anesthesia of the patient is almost never required. These scans cause no adverse effects on the animal, but the patient may need to stay overnight in the hospital until most of the radioactivity caused by the scan is eliminated in urine or bowel movements (fig.7).r to be clearly diagnostic.

Computed Axial Tomographic (CT or CAT) or



Magnetic Resonance (MR) Imaging -

These special imaging techniques are available at referral centers and specialty hospitals.

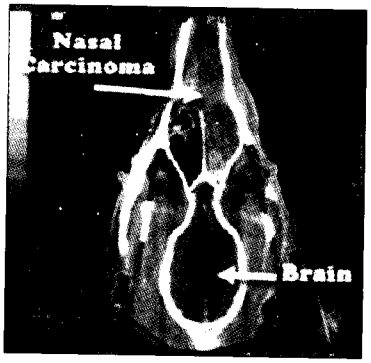
Figure 7: A nuclear scan of a cat with thyroid carcinoma and lymph node metastasis.

A computerized axial tomographic (CT) scanner is an advanced x-ray unit combined with a computer system that makes detailed pictures of cross-sections of the body. Information obtained from x-ray exposures is fed into a computer, and multiple computerized images are formed of sections of the body. The ***radiation*** exposure is minimal and unlikely to cause any side effects, but animal patients must be anesthetized since any movement may make the images unreadable. A CT scan shows more details than a regular x-ray; unlike an x-ray, it can make pictures of areas that are surrounded by bone, such as the brain (fig.8).

Figure 8: A CT scan of an invasive nasal carcinoma in a dog.

Unlike an ultrasound examination, air in structures causes no problems with obtaining an image with a CT scan. Scans produced by a CT scanner can show ducts, blood vessels, tumors, or provide images of any of the body's internal organs. A CT scan is many times clearer than an ordinary x-ray; as a result, these more advanced scans may detect some problems at an earlier stage than x-rays.

Magnetic resonance imaging (MRI) is the most advanced diagnostic imaging study clinically available today. MRI images are formed by the combination of a strong magnetic field interacting with hydrogen protons in the body. Exquisitely detailed three-dimensional images are created by a computer based on measurements of signals emitted from these hydrogen protons. MRI does not use radiation or have any harmful effects; again, however, anesthesia is required for animals so that they do not move during the scan. The information obtained from MRI can refine the medical diagnosis, while potentially making more invasive testing procedures unnecessary.



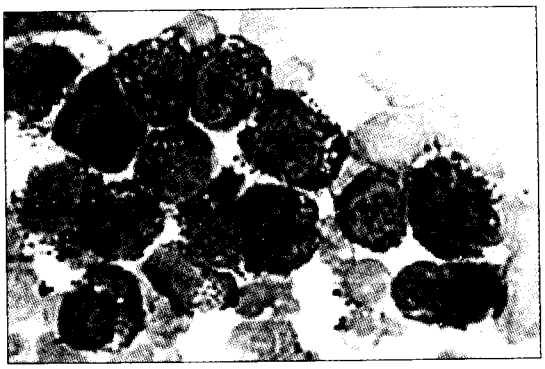
Exfoliative Cytology -

Examination of cells aspirated or imprinted from body cavities, mammary gland secretions, nasal discharges, bronchial washings, bone marrow, lymph nodes, and various "lumps and bumps" has come into increasing popularity in recent years for the diagnosis of neoplastic disease. The procedure is relatively painless for the animal—no more painful in most cases than a vaccination. Sometimes the purpose of the cytologic examination is to determine the cause of a swelling or mass on the pet; bacterial infection or fungal disease may be diagnosed and treated in this way. Sometimes, however, the cytologic diagnosis of cancer is definitively made, as in the case of a ***mast cell tumor*** with characteristic purple granules in the cells (fig.9).

Figure 9: Cells from a heavily granulated mast

cell tumor.

This may allow the treatment of the tumor when it is still very small, greatly increasing the chances of a

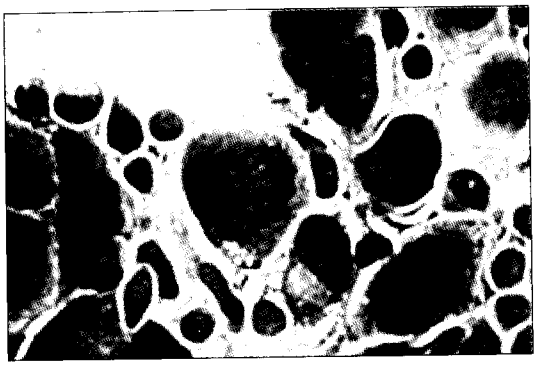


cure. Collection of neoplastic cells from an organ can be the main diagnostic tool used to determine whether surgery, ***radiation therapy***, or chemotherapy should be used in a case. Since cytologic techniques are generally easy and safe to perform, many major diagnostic procedures requiring anesthesia and surgery may be prevented. For example, the number of exploratory thoracotomies (surgery of the chest cavity) and liver biopsies at our teaching hospital has been greatly reduced since we began to do lung and liver aspirates routinely. During a surgical procedure,

cytology may take the place of a ***frozen section***, giving an immediate answer as to whether a mass is malignant. This "instant" cytology sometimes allows an owner to make a decision as to whether to proceed with the surgery (for example, if cancer is found to have spread widely), or may allow the surgeon to make a decision about removing lymph nodes or performing a biopsy of an internal organ (fig.10).

Figure 10: Widespread nodular metastasis in the liver of a dog.

In human hospitals where cytology is an important diagnostic tool and is routinely used, more than 75% of surgical lymph node biopsies are reported to be prevented by findings of aspiration cytology. One veterinary study found an overall 90.4% agreement between diagnoses obtained by aspiration cytology and the surgically-obtained biopsy. In human hospitals, cytology is reported to make an accurate diagnosis 95% of the time.



It must be recognized, however, that cytologic material does not always give a representative picture of the ongoing process. Some tumors do not easily shed tumor cells, even with the suction of a syringe during the aspiration procedure. The ***cytopathologist*** (the individual trained to make a

diagnosis from cytologic specimens) must always be aware of the limitations of cytology. For example, a tumor aspirate that reveals numerous cancer cells is diagnostic for ***neoplasia***; on the other hand, an aspirate of the same lump revealing only blood does not eliminate cancer as a diagnosis (fig.11).

Figure 11: Cytologic specimen from a mass

demonstrating numerous malignant characteristics.

The range of classifications used to describe the cells seen in exfoliative cytology may be expressed as follows:

Absence of atypical or abnormal cells

Atypical cells present but lack evidence of ***malignancy***

Cells suggestive of malignancy

Cells strongly suggestive of malignancy

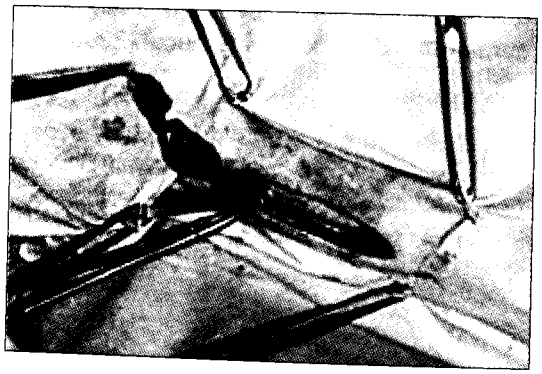
Cellular evidence conclusive for malignancy

Diagnosis deferred, such as unsuitable sample; resubmission suggested

It is important to realize that the efficiency and reliability of cytology depends to a great extent on the cytologic training of the clinician (technique in obtaining specimens, persistence if the first aspirate reveals an equivocal diagnosis) and the experience of the cytopathologist.

Surgical Biopsy -

Surgical biopsy is the most common and the most certain way to make the diagnosis of cancer in both animals and humans



After the tissue is removed from the tumor, a ***pathologist*** will examine the tissue under a microscope to check for cancer cells; this examination may be expected to yield an accurate diagnosis about 90% of the time. Misdiagnosis can occur if too small a sample is submitted or if an area of the tissue that does not contain tumor cells is accidentally selected for biopsy. For example, it is not uncommon for a biopsy from an osteosarcoma to be misdiagnosed as "reactive tissue," due to the fact that these tumors contain a great deal of necrosis (dead tissue), fibrous tissue, and new bone; if these "***benign***" areas of the tumor are inadvertently biopsied, the pathologist will not find malignant cells.

An encapsulated tumor is easy to completely surgically remove; however, many malignant tumors have poorly defined borders. These types of tumors require wide excision and submission to the pathologist of all borders of the excised tissue to determine whether any tissue has been left or not.

The surgeon will mark the specimen, identifying the various borders as "right", "left" "cranial" (toward the head), and "caudal" (toward the patient's tail or rear end) (fig.13). Then, the pathologist will take sections from various areas around the margins of the tumor to check for any remaining tumor cells; if some are found, he or she will be able to indicate to the surgeon exactly where tumor is still present. If possible, more surgery can be done to get wider margins at that particular area, which can then result in a surgical cure.

There are two types of surgical biopsies: 1) incisional and 2) excisional. An ***incisional biopsy*** removes a small piece of a tumor, while an ***excisional biopsy*** usually removes the entire tumor and surrounding normal tissue (fig.14).

An excisional biopsy is always preferred, since it removes the entire tumor. An incisional biopsy may be chosen instead for the sake of convenience, as in the case of a needle biopsy of a mass in the liver. Sometimes, however, an incisional biopsy is the only possible means of obtaining the diagnosis, since the tumor is so large or invasive that complete surgical excision would be impossible. An example would be an extensive sarcoma of the muscles over the back of the skull.

Does a surgical biopsy cause a cancer to spread? The answer in nearly all cases is, "No." A few types of cancers do have the potential to spread into the surgical wound when an incisional biopsy is done, however, this is quite uncommon (fig.15). Figure 15: A tumor nodule tranplanted into the incision site after surgery on a bladder mass. So,

surgeons doing such a biopsy must be certain that the skin surrounding the biopsy site is in a location that can later be completely removed as part of the follow-up operation to remove the entire cancer. It is commonly believed by the public that a tumor will spread if it is exposed to air during surgery, or that the cancer will grow more rapidly if it is removed; these are only myths and have no basis in fact. If you delay treating your pet with surgery because of one of these myths, then you may be losing the chance for a cure. The best chance of a cure from most types of cancer is to remove all cancer cells as early as possible after diagnosis. It is rare that chemotherapy or radiation therapy alone will provide a cure. Usually, surgery is needed and can be the first and most important treatment your pet has (fig.16). Figure 16: Surgery to remove a thyroid tumor.There is some research in laboratory animals to suggest that removing a ***primary tumor*** might cause small metastases that are present elsewhere in the patient's body to begin growing. Although this may occur in some very rare instances, this concern is less important than problems that can arise if the primary cancer is not removed. As long as the primary cancer is present, its cells may continue to spread to other parts of the body. Certainly, chemotherapy and radiation therapy are almost always more effective after most of the cancer has been removed by surgery. And finally, removal of the primary tumor is usually helpful in preventing potentially life-threatening complications caused by continued growth of the mass.

Other Methods - Some human tumors produce "marker" substances found only when the tumor is present, such as carcinoembryonic antigen (CEA) produced by colon carcinoma. A substance called alpha- fetoprotein (AFP) is found in the blood of humans with hepatocellular carcinoma (liver cancer). Recently, prostate-specific antigen (PSA) testing has been widely used in human males to make an early diagnosis of prostatic carcinoma. Unfortunately, such tumor "markers" have not been discovered for animal tumors as yet. ❑

(.....Continued from page 33)

has become wide spread, large quanties of different plastic materials are often scattered in and around animal habitation, becoming a menace to ruminants. Cattle and buffaloe due to their indiscriminate feeding habits leads to ingestion of foreign bodies which would be rejected by other species (Radostitis et al., 1994). Narasimha Rao et.al. (2001) recovered 3.85 kg of plastic material from rumen of a buffalo bull calf. Clinical manifestation in the present case was in agreement with Satish Kumar et.al (2003).

Acknowledgement

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INFOMANIA

1. Which animal's name comes first in the standard English dictionaries?
2. A dog of most beautiful ugliness- which breed is referred to with this compliment?
3. Which breed of dog derives its name from the French word for butterfly?
4. A serious outbreak of which disease prompted the founding of the first Veterinary College in Lyons, France in 1762?
5. Name the world's smallest mammal
6. Which bacteria causes the fatal Haemolytic uraemic syndrome in man and is a food related intoxication?
7. How many recognized blood group systems are there in cattle? What are the blood groups of clinical interest?
8. Van den Berghs test is used for what purpose?
9. Name the new web based software developed by NIC for AHD.
10. Name the beef breed which is famous for "double muscling".

(ANSWERS ON PAGE - 46)