A Practical Approach to Surgical Oncology

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In spite of our improved understanding of cancer molecular biology, the majority of curative cancer treatments include surgical resection of the tumor. The aims of treating cancer surgically include:
- Complete removal/control of the primary tumor and regional metastases;
- Maintaining normal function; and
- Minimizing risks and side effects from the procedure(s).

Surgical treatment of cancer is more likely to be successful early in the disease process before the primary tumor is large and before regional and distant metastatic disease has developed. Annual veterinary visits where detailed physical examinations are performed may facilitate early cancer diagnosis and treatment. A history of a new or growing mass, non-healing wounds or ulcers, loss of appetite, unexplained weight loss or lameness, exercise intolerance or fatigue, or an unusual odor or discharge from the mouth, ears, nose, rectum or vagina should prompt a thorough diagnostic investigation.

The physical examination and any subsequent diagnostic imaging should define the local and regional extent of the disease and determine if distant metastases have occurred. The type of local disease involvement will obviously vary with the type and location of the tumor. For oral tumors, for example, the extent of involvement of the mandible or maxilla is important to consider when planning possible mandibulectomy or maxillectomy. For body wall or appendicular soft tissue sarcomas, the involvement of deeper structures will determine the feasibility of surgical resection and the type of surgery required. For example, an appendicular soft tissue sarcoma that is not extensive and not invading underlying muscle may be amenable to regional resection with a wide margin; a more aggressive tumor may require limb amputation. Evaluation of the regional lymph nodes is also a vital part of the physical examination of the cancer patient. A complete physical examination and subsequent blood work are also important to evaluate older animals for concurrent diseases.

A definitive diagnosis is often the most important information the veterinarian and owner can have when planning treatment. A definitive diagnosis can often be obtained from cytology for cutaneous or subcutaneous masses; biopsy may be required when cytology is not available or is initially non-diagnostic. A biopsy can be performed with one of several available biopsy needles. For tumors within the abdomen or chest, ultrasound or computerized tomographic (CT) guidance allows accurate biopsies of most lesions. An accurate biopsy diagnosis characterizes the tumor and allows the clinician to assess its likely biologic behavior. When performing a surgical biopsy it is important to consider the tumor’s location and the likely plan for a definitive surgery. The biopsy should be performed in such a manner that the entire incision remains well within the field of the definitive resection.
Staging is performed to assess the extent of the disease. The diagnostic tests performed to stage an individual tumor depend on the suspected tumor type, its likely biological behavior, and its location. For some tumors such as osteosarcoma, thoracic radiographs, including opposite lateral views, are mandatory to assess the lungs for metastatic disease. Computed tomography is more sensitive for detecting small pulmonary metastases than even high quality digital radiographs. Mast cell tumors preferentially involve the liver, spleen, and sometimes bone marrow, so abdominal ultrasound and bone marrow aspiration is a more appropriate investigation. Anal sac tumors can metastasize to the hypogastric and iliac lymph nodes, lumbar vertebrae and lungs, so a complete staging would include abdominal ultrasound, and radiographs of the lumbar vertebrae and lungs. Any enlarged regional lymph nodes should be aspirated or biopsied to assess the extent of disease and improve an assessment of prognosis.

Paraneoplastic syndromes are an important preoperative concern as they can affect the safety of surgery (coagulopathy, anemia) or reflect a poorer prognosis (hypercalcemia). A complete blood count, platelet count, biochemical profile, serum electrolyte levels, and possibly coagulation screen are performed depending on the suspected tumor type.

Surgical resection of tumors is most often performed with the intent of curing the animal. Surgery is sometimes performed to debulk a tumor that will then be treated with radiation therapy, or to prevent or stop life threatening hemorrhage and obtain a definitive biopsy (splenic hemangiosarcoma). The rationale for the surgery should be clear and discussed with the owner frankly. The likely result of surgery should be presented and compared to palliative treatment. For example, amputating the limb of a dog with osteosarcoma will not in itself result in increased survival unless the dog receives chemotherapy. Similarly, performing a splenectomy for a bleeding splenic mass stops hemorrhage and allows for a biopsy diagnosis but does not provide a substantial survival benefit unless postoperative chemotherapy is administered.

In cases where curative surgery is possible, margins should be carefully planned. Advanced imaging, including computerized tomography with 3 dimensional reconstruction is often very useful in visualizing the extent of the tumor and clearly delineating the structures that will likely be encountered in a resection with wide margins. Surgical considerations vary widely with the tumor type. Preoperative blood typing and cross matching are performed in animals with extremely vascular tumors. Part of the surgical plan involves dissecting and controlling blood supply to vascular tumors before definitive attempts at tumor removal. This may involve placing Rummel tourniquets on the cranial and caudal vena cava and the azygous veins in a dog with right atrial hemangiosarcoma, rapidly dissecting and occluding the splenic artery in a dog with a bleeding splenic mass, or isolating the renal veins and the caudal vena cava distal and proximal to an invasive adrenal tumor.

Reconstruction of the defect left after tumor and margin removal resulting and the likelihood of postoperative adjunctive therapies should also be considered in the surgical plan. Reconstruction may involve internal or external skeletal fixation, mesh repair of
thoracic or abdominal wall defects, axial pattern flaps, or free skin grafts. The necessity for adjunctive therapies including chemotherapy and radiation should be considered when determining the surgical plan. Areas that will likely require radiation postoperatively should ideally be reconstructed with surrounding full thickness skin or axial pattern flaps rather than skin grafts. In animals receiving postoperative chemotherapy, incisions should be closed with single interrupted sutures in holding layers such as the linea alba. Slowly absorbable (Polydioxanone-PDS) or non-absorbable suture (Prolene) is used.

All excised tissue is submitted for histopathological examination. The margins should be inked and areas of interest or concern can be marked with small sutures placed in the specimen after surgery. A concise history and description of the tumor and surgery can be extremely helpful to the pathologist. Information on tumor type, tumor grade, margins, vascular and lymphatic invasion and regional lymph node involvement are vital for determining prognosis and adjunctive treatment.

There are several postoperative considerations specific to endocrine oncologic surgery. Removal of a functional endocrine tumor results in a sudden drop in the hormone the tumor had been producing. This means that careful monitoring is required. For example in cases where a functional parathyroid tumor has been removed, serum or ionized calcium levels are periodically monitored and the animal evaluated for clinical signs of hypocalcemia. Serum calcium levels <8.5-9 mg/dL or ionized calcium levels <1mmol/L should prompt calcium supplementation and treatment with a Vitamin D analogue (dihydrotachysterol). In dogs that have had a cortisol producing adrenal tumor removed, glucocorticoid supplementation is often necessary to prevent glucocorticoid insufficiency.