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## PRINCIPLES OF ONCOLOGICAL SURGERY

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Oncological surgery is probably the most interesting surgery a veterinarian can carry out. It involves aspects of soft tissue surgery, orthopedic surgery and neurological surgery, and demands a comprehensive knowledge of anatomy and reconstructive procedures for tissue deficits.

In many respects there are no rules on what can be carried out – we are just starting to push forward the boundaries on the surgical procedures that can be employed to treat localized cancer in small animals. However, if oncological surgeries are to be effective and successful, there are certain principles that must be adhered to. Compared to other treatment modalities, surgery of localized tumors provides for an immediate cure, is not carcinogenic, not immunosuppressive and does not have local toxic effects. With sensible and appropriate anesthetic and analgesic protocols and adherence to the following principles of oncological surgery, any morbidity associated with anesthesia and surgery can be minimized and a successful outcome realized.

Surgery may be used in oncology for a wide variety of reasons but is mainly used to allow a diagnosis and treatment of localized neoplasia. Before surgical treatment of a cancer is ever contemplated, a full assessment of the situation must be made:

1. The type, grade and stage of the cancer must be defined. A surgical procedure (biopsy) may be involved in this process.
2. The local and systemic effects of the disease must be assessed using appropriate investigations such as physical examination, blood evaluations, radiography, ultrasonography, CT or MRI.
3. It must be decided whether a cure is possible, and if so whether surgical intervention is indicated. The aim of surgery must be clearly recognized – i.e. whether the aim is a cure, cytoreductive surgery or palliative surgery.
4. The options for alternative treatment must be fully assessed in the light of likely prognosis, as must the effect of adjunctive therapies combined with surgery.
5. The owner must be fully informed of the intent of surgery and of all the adjunctive therapies available, and also of the likely prognosis.

When a decision to use surgery has been made, the best possible outcome will be achieved the first time - second surgeries are less successful. The best chance of a cure is with the first surgery for a number of reasons:

- untreated tumors tend to have more normal surrounding anatomy that facilitates surgical removal
- recurrent tumors may have seeding to involvement of previously non-involved tissue planes, requiring wider resection than would have been required on the initial tumor
- the most active and invasive parts of the tumor are at the edges where the blood supply is best, and subtotal resection may thus actually select to leave

behind the most aggressive components of the tumor

- patients with recurrence often have less normal tissue available for closure

As well as defining the precise role of any surgical procedure before surgery is undertaken, full consideration must be given to the reconstructive aspects if the surgery is to be successful. Tumor resections, particularly those involving the skin and associated tissues, may result in the development of substantial tissue deficits. The lack of pre-operative consideration of a reconstructive plan, and the fear of not being able to close the resulting deficit, are potent deterrents to the first, and the most important stage, the excision - the effective removal of the tumor. Ideally, one individual should remove the tumor, adhering to the oncological principles on the margins required, and a second individual should then perform the reconstruction. This is not feasible in most institutions and practices, and the surgeon must give full consideration to the reconstruction prior to embarking on the excision.

Pre-operative planning of the anesthetic and analgesic regimen and the post-operative care, will minimize peri-operative morbidity.

Broadly speaking, oncological surgery can have the purposes of

- Prophylactic surgery,
- Diagnosis and staging of neoplastic disease,
- Definitive excision,
- Cytoreduction of the tumor mass,
- Palliative surgery,
- Oncological emergencies,
- Support surgeries,
- Surgical treatment of metastatic disease.

### DIAGNOSIS AND STAGING

Attaining a diagnosis and clinical staging of the suspected neoplasia is of paramount importance before any treatment, surgical or otherwise, can be considered. A histopathological diagnosis must be achieved if a prognosis is to be established and the most appropriate surgical procedure or adjunctive therapy instigated. Treatment without biopsy information will at best be speculative and can rarely be justified even in the hands of an experienced oncologist. Biopsy information provides the cornerstone for planning the surgical procedure. For example, certain tumor types, e.g. soft tissue sarcomas, oral fibrosarcomas and mast cell tumors, have a high rate of local recurrence with conservative resection and thus require removal with much wider margins than benign or low-grade tumors. Permanent local tumor control and survival are positively correlated, and pre-operative knowledge of the tumor type will help in planning the correct definitive surgery and thus achieving a local cure.

### DEFINITIVE EXCISION

The choice of the margin at surgery will profoundly affect the success of the surgery as a curative procedure. The margin of grossly normal tissue taken with the obvious 'primary' mass will depend on the histological type and grade of tumor, again emphasizing the need for establishing this information by biopsy preoperatively. The apparently-normal tissue surrounding malignant tumors is frequently infiltrated by neoplastic cells, and in general terms, the greater the likelihood of local infiltration the wider the surgical margin

must be. The extent of the surgical margin can be categorized anatomically as:

- local excision,
- wide local excision
- radical local excision

**Local excision** is the removal of the tumor with the minimal amount of surrounding normal tissue. This often means removal of the tumor through its natural capsule or immediate boundaries. Although an additional margin of normal tissue is usually removed there are some instances when it is desirable not to exceed the boundary of the tumor so as to preserve vital surrounding tissue - for example, removal of feline thyroid tumors with preservation of the parathyroid tissue, or removal of central nervous system tumors with preservation of surrounding neuronal tissue.

**Wide local excision** is where a significant predetermined margin of surrounding tissue is removed together with the primary mass, the excision is termed 'wide local excision'. Again, pre-operative knowledge of the tumor type and grade, obtained after appropriate biopsy, is essential in deciding on what an appropriate margin is. Anatomic considerations may dictate whether it is possible to resect the mass with the appropriate margin, and if not, consideration should be given to the use of appropriate adjunctive therapy. Very often, especially on the limbs, the appropriate depth of surgical margin cannot be obtained without severely compromising function, and in these circumstances use is made of the known biology of tumors. A collagen rich fascial plane (e.g. a muscle sheath or aponeurosis) may act as a natural boundary to tumor spread. This form of surgery (wide local resection) is probably the most difficult because it is so tempting to take less tissue than may be required in order to preserve tissue for closure. Pre-operative planning is essential in these cases.

Radical local excision, supra-radical excision, compartmental excision and amputation. Removal of the tumor with anatomically extensive margins of tissue extending into fascial planes which are undisturbed by the primary growth of the tumor is termed 'radical local excision' or in other instances 'supra-radical or compartmental excision.' Sarcomas in particular extend along fascial planes rather than through them, and this pattern of growth dictates removal of the entire anatomic compartment rather than simply wide margins of tissue. Examples of radical resections include excision of the eyelids and orbital contents for removal of invasive squamous cell carcinomas of the eyelid; total or partial orbitectomy for the treatment of periorbital tumors; radical chest wall resection or abdominal wall resection for the removal of sarcomas; radical resections of the nasal planum and rostral maxilla.

## RECONSTRUCTION OF THE RESULTING DEFICIT

There is often a great temptation to compromise excision margins through a lack of confidence in one's ability to reconstruct the resulting deficit. Compromising the excision margins results in failure of a single surgical procedure that could have produced a cure. It may also result in death of an animal that should have been cured. It is the resection of tumors involving the skin and associated structures that often results in substantial deficits, and a variety of techniques are available to deal with these deficits. The oncological surgeon should be familiar with techniques such as primary skin closure, secondary skin healing, pedicle flap closure of the skin, free skin grafts, local tissue augmentation and mesh implants, but the important thing to emphasize is that a suitable closure technique should be planned prior to resection of the tumor. Should the resection have to be more radical than originally planned, suitable alternatives for closure should have been considered. Most often primary closure techniques are used in veterinary oncology due to the fact that if elaborate cutaneous reconstructive techniques are used, there is potential for very wide tumor recurrence should the resection have been incomplete. An important aspect to remember to minimize this potential for seeding is that separate instruments should be used for the reconstruction part of the procedure.

## SUGGESTED READING

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