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The Evolution of Veterinary Surgical Oncology

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Tremendous change and progress have occurred in the field of oncology over the last several decades. Progression in diagnostic techniques, patient support, adjuvant therapies and surgeon training has allowed the field of surgical oncology to make continued improvements in the human cancer field. Although a relatively young field, veterinary surgical oncology has followed in the progressive footsteps of our human counterparts. This article describes the evolution of this rapidly expanding field of veterinary medicine.

Being offered (ordered) to try to describe the evolution of surgical oncology in veterinary medicine has caused considerable reflection but few hard chronologic or documentable facts. Cancer in animals has been around longer than veterinary surgeons. One of the first documented cases of osteosarcoma was discovered in the bones of a dinosaur in Colorado. Treatment options were limited and the prognosis remained unchanged for hundreds of thousands of years. In both human and veterinary medicine, crude attempts at local resection of cancer were the norm until surgeons were afforded a better playing field of diagnostic, therapeutic, and biologic knowledge. For many years, the Halsted theory of cancer prevailed. This proposed that local cancer spread in a regional (lymph node) fashion and that more and larger surgery would lead to more and more cures. Until cancer was recognized as a systemic disease, with each cancer's behavior dependent on factors such as clinical stage, histologic grade, species, and anatomic site, surgery was usually performed in a pessimistic and conservative fashion. This was reflected in poor outcomes and both underdosing and overdosing of surgery. The mainstay of local disease control for animals with cancer has been and will continue to be surgery, with radiation therapy gaining ground but still a distant second.

Surgical oncology would have had no evolution were it not for parallel and complementary developments of anesthesia, analgesia, antibiotics, cautery, blood transfusions, and intensive care units. None of the larger ablative surgeries would be possible without the dedicated contribution of competent anesthesia and critical care personnel. The surgical procedure itself is only as good as the supporting cast (surgical technicians, students, nurses, owners, and house staff).

For years, surgical oncology was procedure and technique based with little concern for outcome. As outcome data such as local recurrence rates and metastasis became available, it was obvious that conservative surgery often resulted in local relapse and death. As surgery became more aggressive locally, it became apparent that patients could be cleared of the local disease but often failed from metastasis. It should be obvious that surgeons acting in isolation from other oncologic modalities are putting their heads in the sand. Surgeons are slowly evolving from technicians to biologists, and this trend needs to continue if the discipline is to grow. "Biology is King; selection of cases is Queen, and the technical details of surgical procedures are the Princes and Princesses of the realm who frequently try to overthrow the powerful forces of the King or Queen, usually to no long-term avail, although with some temporary apparent victories."[1]

Another major step forward for surgical oncology has been the development of accurate and reproducible imaging studies such as radiography (with many specialized procedures), ultrasound, computed tomography, magnetic resonance imaging, angiography, and nuclear medicine. With trepidation, I can recall the days when an animal with a suspect brain tumor was

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"explored" based on neurologic localization (left- or right-sided lesion) alone. In combination with knowledge of biologic considerations, the more accurate the local staging, the more likely that an appropriate resection will be performed. Gone are the days when all lumps were treated the same.

A major advance in complementary disciplines has been in cytologic and anatomic pathology. Without an accurate diagnosis (preferably preoperative), the surgeon is unlikely to perform the correct procedure. Not only will the surgeon have a histologic name but a histologic grade on which to develop a surgical plan. Evaluation of adequacy of resection (margins) is also an integral part of postoperative management.

As alluded to previously, the concept of surgical dose (just as with chemotherapy and/or radiation therapy) is crucial to individualized and appropriate treatment. Low-dose surgery is appropriate for benign tumors such as lipomas or benign adnexal skin tumors but will not be successful for most intermediate or high-grade malignancies. Surgical doses are customarily defined as intralesional, marginal (on the pseudocapsule), wide (1 to 2 cm margin), or radical (entire compartment such as an amputation). "It is desirable to avoid cutting into the tumor . . . lest the active microscopic elements in it should be set free and lodge in the wound." (Sir Charles Moore, 1867) Unless surgical dose is defined, the interpretation of the surgical oncology literature is impossible.

Performing a less than complete resection, waiting for inevitable local recurrence, and *then* becoming more aggressive and allowing possible metastasis in the interim is a formula for failure. The first surgery may be the only time that local control and prevention of metastasis are possible.

> . . .there must be a final limit to the development of manipulative surgery, the knife cannot always have fresh fields for conquest and although methods of practice may be modified and varied and even improved to some extent, it must be within a certain limit. That this limit has nearly, if not quite, been reached will appear evident if we reflect on the great achievements of modern operative surgery. Very little remains for the boldest to devise or the most dextrous to perform. (John Erichsen, The Lancet, 1873)

Despite this belief, there has been a steady increase in the description of surgical ablative procedures from both a technical and outcome perspective (mandibulectomy, maxillectomy, glossectomy, orbitectomy, nasal planum resection, limb sparing, scapulectomy, hemipelvectomy, and chest wall resection). Parallel and crucial to these resections have been major advances in reconstructive surgery. Owner and veterinary acceptance of mild to moderate cosmetic and functional deficits in exchange for durable long-term remission has been key to widespread implementation of these techniques. Concurrent with the use of new techniques has come a reduction in the use of other techniques due to poor outcome and morbidity. The widespread use of open nasal cavity curettage for intranasal cancer was abandoned when it was noted that no survival increase over no surgery was seen, and the signs of postoperative bacterial and/or fungal rhinitis were worse than the epistaxis secondary to the tumor. Aggressive mastectomy in the dog (and women) has no survival advantage over more conservative procedures but may have a survival advantage in the cat. Complete cystectomy for transitional cell carcinoma of the bladder can be performed technically, but the morbidity and high metastatic rate beyond the bladder make it a questionable procedure at best. Just because a surgical procedure can be done is not the best indication to do it.

Many other complementary techniques to standard surgery are in place or are being developed. Cryosurgery, hyperthermia, phototherapy, and laser surgery have only limited application for malignant disease even though they were originally heralded as possible panaceas. The routine use of stapling equipment for hemostasis, anastomosis, and resection has facilitated more rapid and safe procedures to be performed. Laparoscopic, thoracoscopic, and endoscopic resections will undoubtedly become more popular and useful. Tissue transfer with microvascular anastomosis of vessels should also flourish and allow more creative resections and reconstruction. However, more "toys" and techniques will not replace surgical judgment; the when, why, and how to intervene is the "art" of surgical oncology.

Specific education and training in surgical oncology have been sketchy and scattered in academic curricula and continuing education. The teaching of the procedure (eg, nephrectomy, lung lobectomy, or limb amputation) takes place in surgery courses. The disease afflicting these organs is taught in medicine or pathology courses, but a comprehensive integration of indications, techniques, and outcomes in surgical oncology is generally lacking. I am proud to say that Colorado State University has now produced 10 surgical oncology fellows who spend a 1-year clinical and research position (after a traditional ACVS surgical residency) with the Clinical Oncology Service. I am aware of no other surgery program in veterinary medicine in which surgeons operate only on cancer. The strength of these fellowships lies not only in fine tuning of their surgical skills, but also in an intense exposure to related and complementary disciplines such as medical oncology, radiation oncology, pathology, diagnostic imaging, and molecular biology. As in human medicine, specific board certification in surgical oncology does not exist. Societies such as the Society of Surgical Oncology (formerly the James Ewing Society) and the Musculoskeletal Tumor Society serve an important role in focusing attention on the surgeon's role in cancer. Similar societies are overdue in veterinary medicine. As well as sharing ideas on surgery and its complex interaction in the field of oncology, societies should promote prospective trials to better define surgical oncology outcomes. Board certification in medical oncology and radiation oncology should prompt consideration of certification in the unique area of surgical oncology. Close interaction and collaboration with our physician counterparts can only be positive for all concerned. It is really all one medicine simply applied to different species. Because of the diversity of organ systems affected and the need for some level of expertise in orthopedic, soft tissue, neurologic, and reconstructive surgery, the surgical oncologist is the true definition of a general surgeon. This can be both challenging and demanding.

The goals of the operative intervention should be defined before the surgery whenever possible (ie, diagnosis, palliation, or cytoreduction [to augment adjuvant treatments] or cure). The team approach with allied disciplines such as medical and radiation oncology is the key to optimal patient care. A silver bullet for nonsurgical cure of cancer is not on the horizon, and our goal is not to concentrate on more and larger resections, but rather perfecting the ones we have, understanding their indications, and more important improving our outcomes (disease free interval and survival) with more accuracy. Public

and professional demand for competent surgical oncologists and oncology teams should encourage growth of this challenging and important discipline of surgical oncology.

The future holds change and, it is hoped, progress. With the outpouring of almost 100 new ACVS and ECVS diplomates each year, it is crucial that surgical oncology is taught and practiced in a realistic, scientific, and disciplined fashion. "This is not the end, it is not even the beginning of the end. But it is perhaps the end of the beginning," (Winston Churchill, 1942).

Reference

1. Cady B: Basic principles in surgical oncology. Arch Surg 132:338-346, 1997