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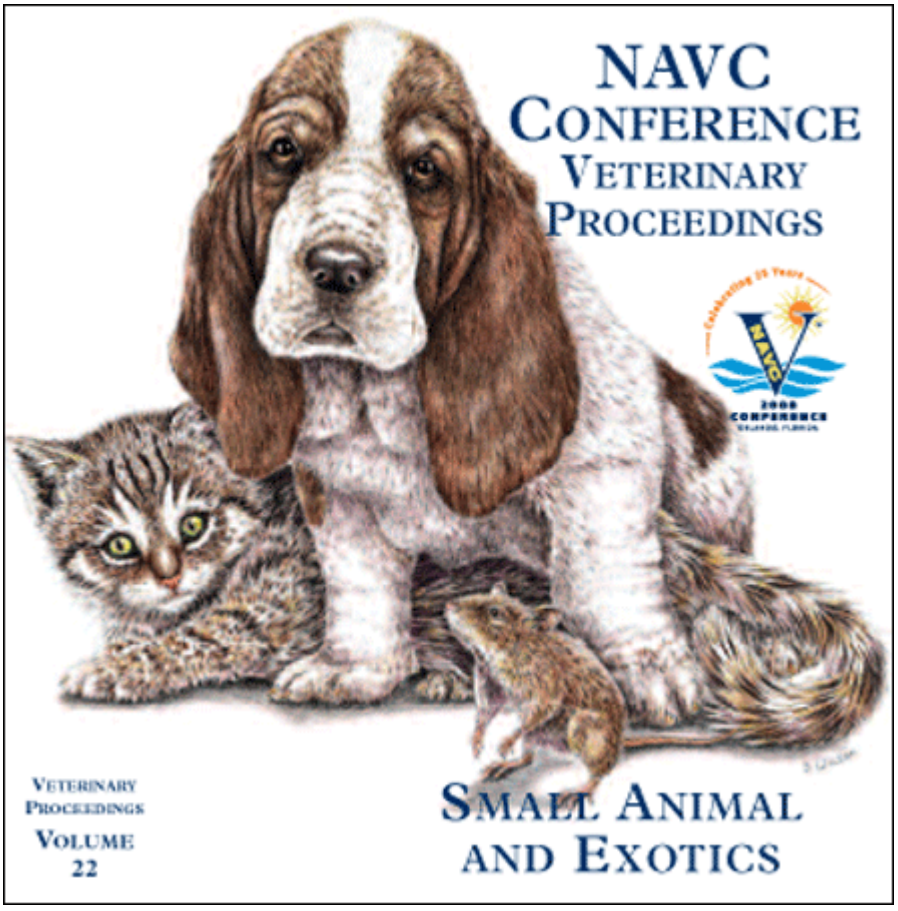

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SOFT TISSUE SARCOMAS: YOUR QUESTIONS ANSWERED

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The soft tissue sarcomas are a group of tumors with differing morphologic features that share similar biologic behaviors. They occur in both humans and animals and include a variety of tumor types. These tumors arise from a variety of non-bone connective tissues and may originate in visceral and non-visceral sites. Soft tissue sarcomas constitute approximately 15% of all skin and subcutaneous tumors in the dog and approximately 7% of all feline skin and subcutaneous tumors. Incidence estimates for canine and feline soft tissue sarcomas arising from visceral sites are less accurate.

Nomenclature given to tumors that are grouped under the soft tissue sarcoma heading include fibrosarcoma, hemangiopericytoma, liposarcoma, rhabdomyosarcoma, leiomyosarcoma, malignant fibrous histiocytoma, malignant nerve sheath tumors (neurofibrosarcoma, schwannoma), myxosarcoma, myxofibrosarcoma, mesenchymoma, and spindle cell tumor. These tumors differ in histologic appearance to various extents and are named after the connective (mesenchymal) tissue from which they are presumed to arise (see Table 1). Despite differing histologic features, soft tissue sarcomas are grouped together because of some important features of biologic behavior that are common to all the soft tissue sarcoma tumors. These features have been described by Withrow and MacEwan and include:

1. An ability to arise from any anatomic site in the body
2. The propensity to appear as pseudoencapsulated tumors with poorly defined histologic margins
3. A tendency to infiltrate through fascial planes
4. Common local recurrence after conservative excision
5. Metastasis through hematogenous routes
6. A poor response to chemotherapy and radiation therapy in cases where gross tumor is present[1-3]

In general, these tumors share a low to moderate metastatic rate and are locally invasive. Other tumors of connective tissue origin such as osteosarcoma, chondrosarcoma, hemangiosarcoma, lymphangio-sarcoma, and synovial cell sarcoma are not usually considered under the soft tissue sarcoma heading because of the relatively higher metastatic rate associated with these tumor types.[1,2] Thus, not all tumors with the "-sarcoma" suffix are included in the soft tissue sarcoma grouping (see Table 1).

Signalment

The median age for dogs affected with soft tissue sarcomas is 10 years with a range from 6 months to 17 years. Although some reviews have suggested a female predisposition, others have not. Commonly affected breeds include boxers, German Shepherds, golden retrievers and Doberman pinschers. Most every breed has been reported, but large breeds seem to be affected more commonly than toy and small breeds

Clinical Signs

Most dogs present with large firm painless swellings, although dogs with nerve root tumors may be exquisitely painful. Tumors of the extremities are typically not associated with lameness, although some dogs with large tumors may demonstrate functional lameness. Subcutaneous sites are most common, and any anatomic site can be affected.

Physical Examination Findings

Most dogs have firm painless swelling of the affected region. There may be functional impairment due physical presence of the tumor. Dogs with oral tumors may be dysphagic.

Clinical Work-up

When a soft tissue sarcoma is suspected, fine needle aspiration should be performed, results may be suggestive of mesenchymal neoplasia, but will rarely be diagnostic. Thoracic radiographs should be performed because, although clinically evident metastasis at the time of diagnosis is rare, its discovery imparts a poorer prognosis. Regional lymph nodes should be evaluated and aspirated if they are enlarged. Lymph node metastasis of soft tissue sarcomas is less common than lung metastasis, but is not rare. Incisional biopsy of soft tissue sarcomas should always be performed prior to

Table 1. Soft Tissue Sarcomas (Low to Moderate Metastatic Rate[1])

Low metastatic rate
- malignant fibrous histiocytoma
- malignant nerve sheath tumor
- hemangiopericytoma
- leiomyosarcoma
- mesenchymoma

Low to moderate metastatic rate
- fibrosarcoma
- myxosarcoma
- rhabdomyosarcoma
- spindle cell tumor
- liposarcoma

Other mesenchymal tumors (high metastatic rate, NOT included under soft tissue sarcoma)
- hemangiosarcoma
- osteosarcoma
- chondrosarcoma
- synovial cell sarcoma*
- lymphangiosarcoma

*Sometimes grouped under the soft tissue sarcoma heading

definitive surgical excision to determine histological type and grade because these help determine prognosis as well as the extent of surgical excision required to achieve clean surgical margins.

Treatment

The mainstay of treatment of soft tissue sarcomas is wide local surgical excision. Surgical margins should be at least 2 cm away from any visible or palpable tumor. With grade III tumors, margins >3 cm may be required to achieve clean margins. Careful consideration of regional anatomy and options for closure should be made prior to surgery. A three-dimensional sphere at the required distance needs to be visualized, and completely excised without regard for surgical closure. Again, the time to consider anatomy at risk and options for surgical closure is before the patient enters the surgical suite. Decisions made under duress during surgery with fears of inability to close frequently lead to malignant cells being left in the patient. Skin grafts and flaps requiring extensive dissection of adjacent tissues should be used with discretion for fear of contaminating large amounts of tissue if surgical margins are incomplete. One option is to leave wounds that cannot be closed with native tissues open to heal by second intention, or to be closed primarily using plastic procedures once surgical margins have been determined to be clean. Surgical margins should be inked and evaluated by a veterinary pathologist. All samples must be submitted for histopathologic evaluation. If margins are found to be incomplete, a second surgery can be performed, where the entire surgical scar is treated as a new tumor and 2-cm margins in all directions are taken. Radiation therapy offers an excellent choice for “cleanup” of incomplete excision of soft tissue sarcomas.

Chemotherapy

Chemotherapy is not routinely indicated in most soft tissue sarcomas. The exceptions to this rule are grade III (high grade) sarcomas. A significantly higher metastatic rate is seen with grade III tumors and as such, adjuvant chemotherapy is indicated to delay or prevent metastasis. Most protocols involve single-agent doxorubicin or combinations therapies including doxorubicin.

Prognosis

Factors which are prognostic include tumor grade, with high-grade tumors having significantly more local recurrence, metastasis, and tumor-related death; patient age, where patients under 1 year of age almost always have high-grade tumors; anatomic location, where tumors of the extremities, below the knee or elbow, almost never metastasize and tumors of the oral cavity have a somewhat higher metastatic rate; the presence of grossly evident metastasis at the time of diagnosis, which imparts a grave prognosis; and the completeness of surgical margins, which is highly prognostic for local recurrence. The median survival time for patients having only aggressive surgical treatment of soft tissue sarcomas is 1400 days. The one-year local control rate for aggressive surgery and for aggressive surgery with adjuvant radiation therapy for incomplete surgical excision is approximately 90%.

ADJUVANT RADIATION THERAPY FOR SOFT TISSUE SARCOMAS

For circumstances where surgery alone cannot ensure complete removal of a soft tissue sarcoma, adjuvant radiation therapy is used. Radiation therapy for soft tissue sarcomas becomes necessary when complete resection is impossible or when the owner refuses the surgical procedure necessary for complete resection. For example, many owners choose marginal resection followed or proceeded by radiotherapy for residual disease rather than amputation (or other aggressive excision) for a pet with a soft tissue sarcoma of an extremity, even though amputation is almost certainly a curative procedure. Because we are dealing often times with soft tissue sarcomas of low metastatic potential (exception is the high-grade sarcomas, which have a 40% to 60% chance of metastasis), a decision for amputation can usually be made later if radiotherapy fails.

With the advent of routine use of megavoltage radiation in veterinary medicine and appreciation of aggressive time-dose fractionation schemes, successful local control of soft tissue sarcomas has been possible. A recent study documented 21 dogs with incompletely resected sarcomas treated with cobalt radiation. The total dose of 63 Gy given in 3 Gy fractions over 7 weeks resulted in 1 and 2 year control rates of 95% and 75%, respectively.

Although radiation therapy is most often given postoperatively in veterinary medicine, some centers are trying to use preoperative radiation therapy for the locally aggressive feline vaccine-associated sarcomas. In 1994, preliminary results from North Carolina State University (NCSU) reported median progression free intervals of 137 days and 280 days for radiation therapy alone versus preoperative radiation therapy, respectively, for cats with vaccine-related fibrosarcomas. Cronin et al published the results on 33 cats treated at NCSU with preoperative radiation therapy. The median disease-free interval and overall survival were 398 and 600 days, respectively. There were 19 treatment failures: 11 cats had only local recurrence, 4 cats developed metastatic disease, 4 cats had local recurrence and metastasis. The presence of tumor cells at the margin of resected tissue after radiation was the only variable that influenced treatment success. The median disease free interval in cats with dirty tumor margins was 112 days versus 700 days for 26 cats with clean tumor margins ($P<0.0001$). Approximately 40% of the cats with clean margins were alive at 3 years.

Although the optimal combination of radiation therapy and surgery is not known, the above results suggest that many soft tissue sarcomas that are not or cannot be completely excised can be controlled for a significant amount of time with the multimodality approach of surgery and radiation therapy. With more frequent use of the grading system for soft tissue sarcomas, more

complete information about risk of metastasis and long-term prognosis may help owners make the best decision about their treatment options.

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