

THE ROLE OF STEREOTACTIC RADIATION THERAPY (SRT) IN CANCER CASE MANAGEMENT

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Expanding Role of Radiation Therapy in Veterinary Oncology

Advances in radiation treatment planning and dose delivery have helped transform the management of many human cancers over the past two decades. Intensity-modulated radiation therapy (IMRT) and stereotactic radiation therapy (SRT) technologies now allow more precise contouring of the radiation dose onto the tumor while sparing surrounding normal tissues. Treatment with SRT can often be delivered in 1 to 5 doses for certain tumors which is very appealing logistically. These treatment modalities have allowed for improved tumor control with fewer side effects for challenging tumors in people, including brain, prostate and head/neck cancers. Over the past 5 to 10 years, these treatment technologies are becoming more readily accessible in veterinary medicine.^{1,2}

As our pets are living longer lives due in part to improved preventative medical care and nutrition, they are prone to developing various forms of cancer at some point in their lives. While the exact incidence of cancer in dogs and cats is difficult to pinpoint, current estimates indicate that approximately 50% of dogs over the age of 10 years will develop cancer.³ In terms of actual numbers, it is estimated that over 4.2 million dogs⁴ and nearly 6 million cats⁵ are diagnosed with cancer in the US annually. The number of veterinary oncology specialists has also grown to over 400 in the United States, making access to advanced care less challenging. More clients are seeking and expecting advanced treatment options for their pets when they are diagnosed with cancer.

The IMRT and SRT technologies make radiation therapy options much more appealing to pet owners from a side effect management and logistic standpoint. It is for these reasons the Team at Iowa State University is working diligently to bring advanced radiation treatment capabilities to the College of Veterinary Medicine within the next year. Our hope is to greatly expand the cancer treatment options available to your patients via a modality (IMRT/SRT) that is effective, has reduced side effects over traditional radiation delivery systems and is logistically feasible for our clients' busy lifestyles. This presentation will focus on the basic science of IMRT/SRT and its clinical uses in dogs and cats.

Clinical Utilization of Stereotactic Radiation Therapy in Dogs and Cats

Terminology associated with the advanced radiation therapy techniques can be confusing and is often used interchangeably. Stereotactic radiosurgery (SRS) is generally administered in one dose and refers to treatment of brain tumors. SRT or stereotactic body radiation therapy (SBRT) are used to describe highly focused radiation treatment that precisely focuses the treatment field on the tumor target via coordination with an advanced imaging system. SRT is typically administered in 2 to 5 treatments and can be administered via linear accelerators with image guidance, gamma knife or cyber knife. SRT requires a macroscopic or gross tumor target and thus is not useful for treating microscopic disease remaining after surgery where other radiation treatment technology must be employed.¹

Common tumors/sites treated with SRT are outlined in Table 1. Published data on each tumor type currently treated clinically with SRT technology is lacking but will hopefully expand as the technology becomes more widely available. Additional tumors/sites frequently treated with SRT technology include tumors of the pelvis, ribs, vertebra, thyroid, lung, mediastinum, heart-base and oral cavity.^{1,2} Advantages and disadvantages of common radiation treatment modalities are summarized in Table 2.¹

Table 1. Summary of Tumors Commonly Treated with SRT

Anatomic Site (species)	Tumor Treated	Response	Reference
Bone (dog)	Osteosarcoma (OSA)	MST* 363 days	6
Brain (dog)	Meningioma (most common)	MST 399 days	7
Brain (dog)	Meningioma (most common)	MST 324 days	8
Brain (dog)	Trigeminal nerve sheath	MST 745 days	12
Sinonasal (dog)	Carcinoma, sarcoma, OSA	MST 255 days (8.5 months)	10
Nasal (dog)	Carcinoma (most common)	MST 399 days	11
Body (cat)	Injection site sarcoma	MST 301 days	9
Intracranial (cat)	Pituitary	85% survival at 2 years	13

*MST = median survival time

Table 2. Summary of Pros and Cons of Common Radiation Treatment Modalities¹

Treatment Modality	Advantages	Disadvantages	Clinical Utility
Traditional manual point calculation (parallel opposed)	Less expensive Treat microscopic disease Even distribution when treating cuboid structures	Over/under dosing more common Uneven distribution of dose for complex shapes No dose painting/shaping	Microscopic disease of extremities Rostral maxilla or mandible Palliative radiation of many sites
Electrons	Limited penetration Treat superficial microscopic disease	Best for flat surfaces	Tumors or tumor beds over thorax and abdomen
IMRT	More effectively spare normal tissue, minimize radiation effects Treat gross or microscopic disease	Requires advanced accelerator/technology	Nasal, oral, brain, body wall and urinary tract tumors
SRT	Treatment completed in 1-5 fractions Minimizes acute radiation side effects	Requires advanced equipment/technology Cannot treat microscopic disease/requires gross tumor	Brain, nasal, bone, thyroid, lung, mediastinal, heart-based tumors Palliative treatment at almost any site

References

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