

Treatment for Osteosarcoma Lung Metastasis in Dogs

Metastasis is more common in dogs with appendicular osteosarcoma, hemangiosarcoma, and chondrosarcoma. Metastasis is rare in dogs with axial tumors, except for osteosarcoma of the ribs, scapula or pelvis.¹ The diagnosis of osteosarcoma with metastatic disease is historically associated with a poor prognosis for long term survival. One study showed that dogs with a Stage III osteosarcoma (*distant metastasis*) showed a median survival time of 76 days, with a range of 0-1583 days with various treatment options including surgery, palliative radiation therapy, and chemotherapy (*Boston et al, JAVMA 2006*).

In other words, without any treatment, the prognosis for this stage of osteosarcoma is about two months. With treatment, about six months.

Diagnosing OSA Metastasis:

The following diagnostic tests may be performed to grade the severity of the metastasis, and determine the appropriate course of action that can provide the best overall quality of life for your dog. Tests are listed in order of complexity and depth.

Diagnostic Method:	Estimated Cost: (varies by location)
Chest X-Rays / Radiographs	\$252
CT Scan of Lungs with interpretation: <i>CT scans are best at detecting small abnormalities, such as metastatic cancer in the lungs. CT Scans require general anesthesia and sometimes contrasting agents must be injected into the body to enhance the images.</i>	\$750
Technetium scan of Legs / Vertebrae and X-Rays of Spine (<i>rarely do people elect to do a full body CT scan for screening the bones due to the cost and associated anesthesia time</i>)	\$450
Abdominal Ultrasound	\$287
Nuclear Scan or X-Rays of the Long Bones. 8 screening radiographs. (<i>A nuclear scan will light up in areas of the affected bone, then x-rays are taken to confirm any lesions. Alternatively, you can do the x-rays as a first line to screen for bone lesions</i>)	\$672

Once confirmed, treatment options for OSA Metastasis include:

Treatment:	Description:	Treatment Notes:	Considerations:	Estimated Cost:
Pulmonary Metastasectomy	Surgical removal of lesions in the lung. One study showed the median survival time after surgery alone to be 176 days (range 20 to 1495 days) with an overall survival time of 487 days from the time of original diagnosis (<i>O'Brien et al Vet Surg 1993</i>).	Candidates include: <ul style="list-style-type: none"> ● those with the primary tumor in remission for >300 days ● only 1 or 2 visible nodules within the chest ● no other metastatic lesions in the body ● a long doubling time of the metastatic lesions (>30 days) 	Will work if no more than 50% of lung needs to be removed. Recovery time: 2 – 4 days in the hospital	\$1500 to \$3000 depending on complications and recovery.

Treatment:	Description:	Treatment Notes:	Considerations:	Estimated Cost:
Palliative Care	IV Chemotherapy	<p>In the metastasis phase of this disease, chemotherapy is not very promising.</p> <ul style="list-style-type: none"> ● One study showed a response rate of 9% with Adriamycin for metastatic disease ● Response rates overall to any chemotherapy at the site have been reported to be 2% 	<p>Standard treatment of one IV infusion, every 3 weeks</p> <p>If a dog has not had previous chemotherapy, there is a slight chance that outcomes rates could be better.</p>	Adriamycin treatment is roughly \$500 per treatment every 3 weeks. Varies according to number of treatments
Metronomic Chemotherapy	<p>Also known as “low dose chemotherapy” designed to arrest tumor blood vessel development (anti-angiogenic).</p> <p>The goal of this therapy is not to eliminate the disease completely, but to achieve “stable disease” to arrest its growth and spread.</p> <p>Anti-tumor effects of similar protocols have been proven in laboratory animals and humans with advanced, chemotherapy resistant cancer.</p> <p>Read More:</p> <p>“Dr. Rosenberg's Thoughts on Metronomics and Supplements”</p> <p>“Metronomic Chemotherapy and Tripawd Nova”</p> <p>“Metronomic Protocol: Jerry's Experience and Other Resources.”</p> <p>“Metronomic Protocol: A Primer for Pawrents”</p> <p>The Angiogenesis Foundation: Osteosarcoma Antiangiogenic Therapy for Canine Cancers”</p>	<p>A Chemotherapy Agent, NSAID and Doxycycline are the three most commonly used drugs in metronomic chemotherapy.</p> <p><u>Cytoxan</u>: a chemotherapy agent given every other day. At this low, chronic dose it's been shown to inhibit blood vessel growth.</p> <p><u>Alkeran</u>: another chemotherapy agent is used in place of cytoxan by some oncologists. In many instances, it has shown greater success in treating mets than Cytoxan.</p> <p><u>Piroxicam</u>: a non-steroidal drug with potent COX-2 inhibiting properties. COX-2 is a receptor that's been found to play a role in tumor development. In one study, 77% of osteosarcoma expressed the COX-2 receptor (<i>Mullins et al JVIM 2005</i>).</p> <p>Other non-steroidal drugs include the name brands of Metacam, Rimadyl, and Previcox.</p> <p><u>Doxycycline</u>: an antibiotic when given at low doses has been shown to inhibit blood vessel formation, which feed tumors. Does not affect the existing tumor(s).</p> <p><u>Fish Oil</u>: The anti-tumor properties proven in fish oil supplements are showing promise in metronomic therapy.</p>	<p>Non-steroidal drugs help keep inflammation down, which can keep cells in better condition and more resistant to further cancer damage, resulting in better overall health for the patient.</p> <p>Treatment can be given at home.</p> <p>Side effects rarely include: bone marrow suppression, and inflammation of the bladder wall (cystitis). There is about a 5% chance of this occurring, but a greater risk in female patients..</p> <p>CBC blood counts will be monitored periodically.</p> <p>This treatment is still undergoing study, therefore a life expectancy prognosis cannot be given with any certainty.</p>	<p>Depending on the dog's size:</p> <p>Cytoxan: varies from \$100 to \$200 per month.</p> <p>NSAID: varies from \$50 to \$100 per month.</p> <p>Doxycycline; varies from \$30 to \$60 per month.</p>

Treatment:	Description:	Treatment Notes:	Considerations:	Estimated Cost:
		<p><u>Lasix</u>: A diuretic to prevent bladder infections commonly caused by chemotherapy agents, is often given, especially for female patients.</p> <p><u>Bisphosphonates</u>: Some oncologists are using this not only to alleviate pain in dogs who aren't amputation candidates, but because bisphosphonates (i.e., Pamidronate, Zoledronate) have <u>shown anti-tumor properties</u> in laboratory studies.</p>		

Treatment:	Description:	Treatment Notes:	Considerations:	Estimated Cost:
Clinical Trials	<p>There are always ongoing clinical trials that may be available in their area (usually through veterinary universities) and inhalational chemotherapy (Inhaled <u>gemcitabine</u>) as an option for pulmonary metastasis.</p> <p>Read More:</p> <p><u>“Dog Cancer Clinical Trials: What You Need to Know.”</u></p> <p><u>“Tika's Interleukin Inhallation Therapy.”</u></p>	<p>Many private and public veterinary teaching hospitals conduct osteosarcoma clinical trials. Visit the <u>Tripawds Resources Page</u> to find a pulmonary metastasis clinical Trial near you.</p>	<p>Among a variety of other requirements, clinical trials can require participant to:</p> <ul style="list-style-type: none"> live within the area agree to having an autopsy performed on the participating canine agree to a designated number of follow up visits and tests agree to abide by nutritional exclusions /additions and lifestyle requirements for controlled studying. 	<p>Varies. Some trials will cover all costs associated with treatment, some will partially cover.</p>

¹American College of Veterinary Surgeons, Bone Tumors in Cats and Dogs.

Many thanks to Dr. Marie Janson, DVM, DACVIM (oncology) of Animal Hospital Specialty Center in Highlands Ranch, CO for her assistance in this documentation.