LIVS IN PLAIN VIEW

Long Island Veterinary Specialists

Where You Refer Your Patient First Makes All The Difference

INSIDE THIS ISSUE

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Therapeutic Management of Systemic Hypertension

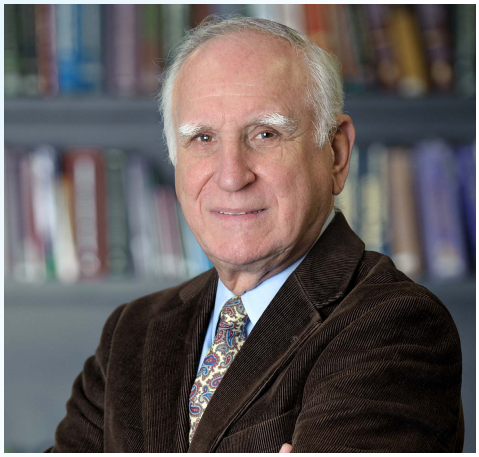
Joshua W. Tumulty, DVM, DACVIM (SAIM)
Dept. of Internal Medicine

Because of its silent nature, hypertension is possibly one of the most underdiagnosed systemic illnesses that affect companion animals. Patients are often presented for evaluation associated with complications of undiagnosed hypertension (retinal detachment/blindness). The veterinary community has been slow to embrace the practice of routine screening for hypertension despite the realization that persistent elevations in blood pressure can have serious and possible life-threatening consequences.

The most important component of therapy is control of the underlying or causal disease. Patients with elevated blood pressure are clinically classified as having situational hypertension (physiologic), primary (essential/idiopathic) or secondary hypertension. ***Situational hypertension*** is caused by autonomic nervous system alterations that arise from the effects of excitement or anxiety on higher centers of the central nervous system. This type of hypertension resolves under conditions that decrease or eliminate the physiologic stimulus (elimination of stressors / triggers for anxiety). ***Primary hypertension*** is the result of an imbalance in the relationship between cardiac output and systemic vascular resistance. ***Secondary hypertension*** is elevated blood pressure that occurs because of systemic disease or medication. Although primary hypertension accounts for more than 90% of all cases of hypertension in humans, secondary hypertension accounts for almost all identified cases of elevated blood pressure in veterinary patients. Systemic hypertension (systolic blood pressure >160 mmHg) secondary to underlying disease has been shown to occur frequently in both cats and dogs. Studies have revealed elevation in systemic blood pressure in 19.4% of cats presenting with chronic renal disease and 17 to 23% of cats with hyperthyroidism. Cats with proteinuria demonstrate a higher prevalence of hypertension. Dogs may have prevalence rates of 60 to 80% (chronic glomerular disease) and 70 to 75% (hyperadrenocorticism), often associated with the presence of concurrent proteinuria.

Continued on page 5

A NOTE FROM THE EDITOR



We have seen lots of snow by this time in the winter in years past; we have been lucky so far, however LIVS is prepared to remain open, as before, in any eventuality. The floods and mudslides in California, snowstorms in the middle of the country and tornadoes in the southeast have been in the news in early 2023 reminding us that Mother Nature always has the last word.

Innovations in pet care diagnostics and treatment permit us to remain in the forefront of cutting edge veterinary care locally, nationally and worldwide. Staff members at LIVS continue to lecture nationally and internationally bringing news of these innovations to a broad audience of veterinarians. The innovative care and publications that have come from LIVS are testament to the energy and enthusiasm of our staff. Lectures are currently being given to the veterinary students there at LIU in Old Westbury and at LIVS by our staff specialists and team members.

Twenty-five years ago LIVS was founded evolving from "Island Veterinary Referral" a three thousand square foot facility in Levittown NY. Fifteen years ago LIVS went from an eight thousand square feet facility to twenty thousand square feet; now in its twenty sixth year, it encompasses approximately thirty thousand square feet and is an imposing site as viewed from the LIE. It is with personal pride that this editor, who in Super Bowl numbers has reached XC years, has served as surgical assistant to the chief of staff at LIVS in 700 total hip replacement procedures since the first one in 1998. LIVS is the focus of more successful standard, mini, micro and nano total hip replacement procedures than any veterinary facility in the world.

In this, the twenty fifth year publishing "LIVS in PlainView", we again anticipate reflecting the events, comments and publications of members of the LIVS staff in our newsletter.

After an intense semester of Parasitology at Suffolk County Community College a few years back, I came to the understanding that everything is a parasite/symbiont of something else. When it comes to fish, no matter if farmed or wild, freezing it at about 0° F for a week, and baking it for 20/25 minutes at 375°F will kill any parasites present. Cold smoking, marinating and pickling does not kill the tapeworm; works for Cestodes, Trematodes and Nematodes as well. China produces 40% of the world's fish and the U.S. imports 50% of their production. Sometimes human waste is fed to and consumed by the fish! Between, COVID and Fish. Ugh! Nematodes are found in cod, herring, mackerel, salmon and squid and are eaten in the larval stages by fish/squid and become paratenic hosts, then we humans eat them. Another ugh! Concerns about parasites in our foods encourages me to freeze all meats I purchase at just about 0° F for a week, and then

it's baked for 20/25 minutes at 375°F, or broiled till any barely pink color appears. Ancylostoma duodenale, Necator americanus and Ascaris lumbricoides etc., give me a wicked incentive to cook thoroughly.

On a more pleasant note, the Christmas/Holiday party hosted by the Wallers was a successful and joyous event always happily anticipated by everyone at LIVS.

While the renovation process at LIVS is progressing, all our departments remain fully staffed to serve our patients all hours of every day and night. Consultations and appointments can be made by calling (516) 501-1700. As before we welcome all comments; please submit them to lmarino@livs.org

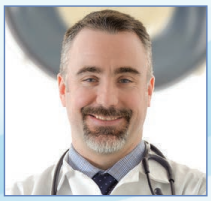
-Leonard J. Marino, MD, FAAP, LVT

Where You Refer Your Patient First Makes All The Difference

Jonathan Goodwin, DVM, MS
DACVIM (Cardiology)
Cardiology

Shadi Ireifej, DVM
DACVS
Director, Emergency Services

Michel Selmer, MS, DVM
CTCVMP, CVMMP
Integrative Medicine



Joshua W. Tumulty, DVM
DACVIM (SAIM)
Internal Medicine,
Radioiodine Therapy

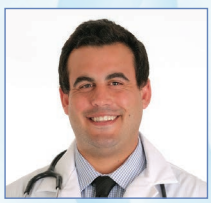
Neil Mittelman, DVM
DACVIM (LAIM; Neurology)
Neurology/Neurosurgery

Patrick F. Roynard, DVM, MRVCS
DACVIM (Neurology)
Neurology/Neurosurgery

Nicole Leibman, DVM
DACVIM (Oncology)
Oncology,
Radiation Therapy

Kay Kim, VMD
DACVO
Ophthalmology

John S. Sapienza, DVM
DACVO
Ophthalmology



Kevin Barber, DVM
DACVS-SA
Surgery, Neurosurgery

Jaclyn Holdsworth, DVM
Surgery Clinician
Surgery, Neurosurgery

Catherine A. Loughin, DVM
DACVS, DACCT
Surgery, Neurosurgery

Dominic J. Marino, DVM
DACVS, DACCT, CCRP
Surgery, Neurosurgery,
Radiation Therapy,
Physical Rehabilitation

Robert Waddell, DVM
DACVS-SA
Surgery, Neurosurgery

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Michel Selmer, DVM MS, CTCVMP, CVMMP

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- Herbal Medicine
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Therapeutic Management of Systemic Hypertension

Continued from front cover

Blood pressure is ultimately a function of cardiac output and systemic vascular resistance, both of which are directly and indirectly affected by the complex interactions among the autonomic nervous system, the renin-angiotensin system, and endothelial signaling mechanisms. The mechanisms by which the kidney triggers hypertension are unknown, and even minimally or non-azotemic animals may be hypertensive. Proposed mechanisms of hypertension with renal disease include failure to excrete a normal quantity of salt or fluid, a stiffening of the venous capacitance system, alterations in adrenergic activity, activation of the RAAS axis, stimulation of renopressor systems, suppression of renodepressors or prostaglandins, and increased cardiac output secondary to anemia. The diagnosis of hypertension associated with chronic renal disease necessitates life-long antihypertensive treatment, while hyperthyroid-associated hypertension may resolve with restoration of euthyroidism. Dogs with successfully managed endocrine disease may continue to have systemic hypertension.

The therapeutic goal for patients with systemic hypertension is to bring the blood pressure out of the range in which target organ damage can be expected. Typically, systolic blood pressure (SBP) <160 mmHg is the therapeutic target for most patients. As elevations in blood pressure become more pronounced, clinical signs directly attributable to hypertension may become apparent. The first signs of hypertension often manifest in the eyes, heart, brain, and kidneys. A key point in management is the differentiation between emergency and urgency hypertensive management. Emergency therapy is primarily guided by the concern generated by clinical signs in the patient. Rapid antihypertensive therapy should be initiated in patients with evidence of ocular damage (retinal or intraocular hemorrhage, retinal edema or detachment) or neurologic dysfunction (encephalopathic – obtundation, focal/generalized seizures). Patients presenting with these clinical signs and elevated blood pressure should be treated immediately. Hypertensive emergencies should be treated only at 24-hour hospitals with experience in critical care and continuous blood pressure monitoring equipment. Initial SBP should be decreased by approximately 10% over the first hour and another approximately 15% over the next few hours, followed by gradual return to normal BP.

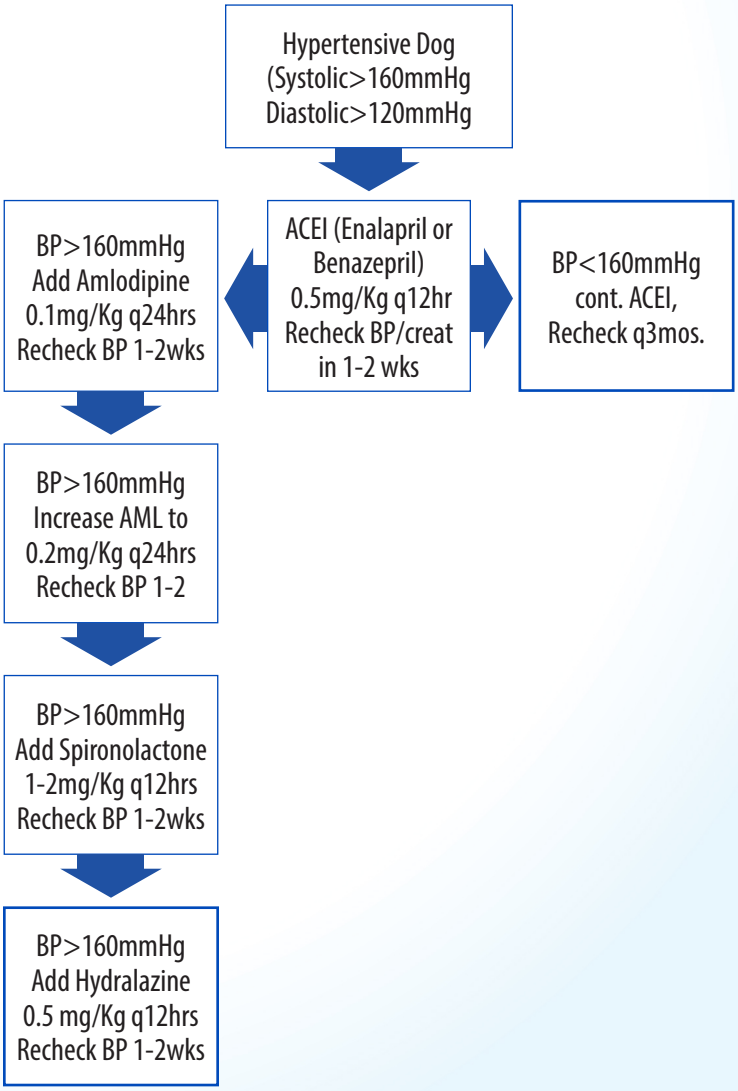
Emergency Therapeutic Recommendations

Fenoldopam: Fenoldopam (Corlopam) is a selective dopamine-1-receptor agonist. Through its dopamine-1 agonist action, fenoldopam causes renal arterial vasodilation, natriuresis, and increased GFR in normal dogs, and it is associated with diuresis in healthy cats, all of which may be beneficial in veterinary patients with hypertensive emergencies. Fenoldopam is delivered as a constant rate infusion (CRI), initially at a dosage of 0.1 µg/kg/min with careful (ie, at intervals of at least 10 minutes) monitoring of BP. The dosage can be titrated up by 0.1 µg/kg/min increments every 15 minutes to the desired SBP, to a maximal dosage of 1.6 µg/kg/min.

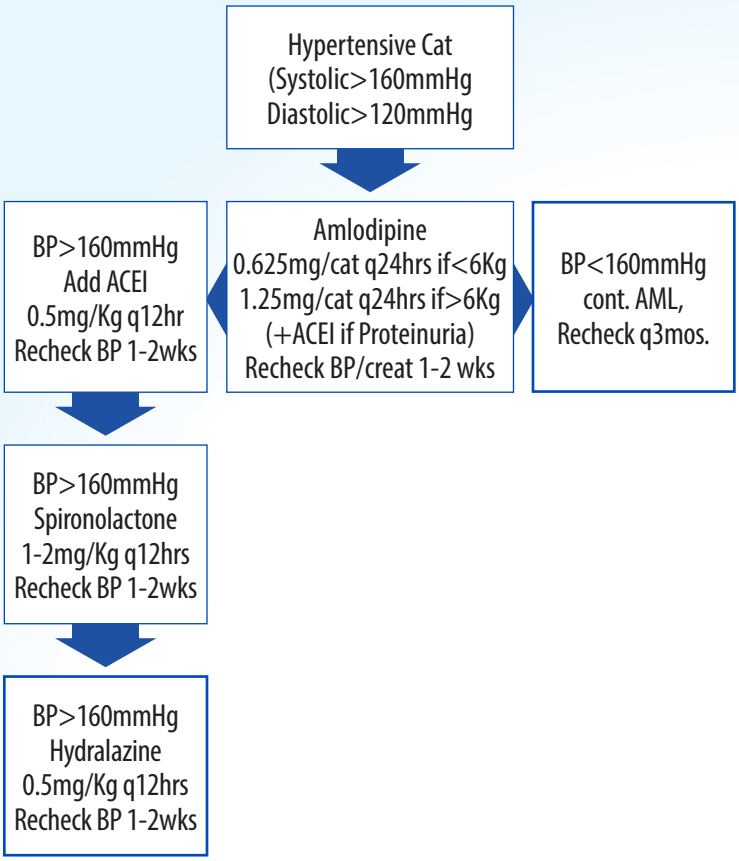
Sodium nitroprusside: Nitroprusside is a nitrate given by constant rate infusion, and has primarily dilating properties when administered by this method. Nitroprusside has a rapid onset of action and is used to correct hypertension on an emergent basis. It has an extremely short half-life, making it appropriate for easy titration. Continuous arterial blood pressure monitoring is highly recommended. Orally administered maintenance drugs may be instituted concurrently.
Dose: 1 – 5 ug/kg/min as CRI.

Hydralazine: Hydralazine is a direct-acting arterial vasodilator with a rapid onset of action. Oral hydralazine is extremely useful for management of emergent hypertension when parenteral therapy is not available. The onset of action with oral administration is approximately 2 hours, with peak effect occurring at about 8-10 hours. The initial dose may be administered, and if required, an additional incremental dose can be added if hypertension persists after 4 hours.
Dose: 0.5 – 2 mg/kg PO BID

Chronic Therapeutic Strategies – Canine: Figure 1



Chronic Therapeutic Strategies – Feline: Figure 2



Oral Antihypertensive Therapies

Amlodipine: Long-acting dihydropyridine calcium antagonist drug that is considered the drug of choice for hypertensive cats. It may be combined with either ACEI or β-blocker. The clinical effects are at least 30 hours. Administered once daily based upon long half-life (30 hrs in dog, 35 hours in humans). Dose: 0.625mg/cat SID titrating up. 0.1 – 0.5mg/kg SID for canine patients.

Enalapril / Benazepril (ACEI): In dogs with mild renal impairment, a 33% reduction in the dose of enalapril is recommended. The main route of elimination for enalaprilat (metabolite of enalapril) in the dog is the kidney (~85%). Benazeprilat is excreted in both the bile and urine in the dog (~50:50), and no change in necessary in the dose in dogs with mild renal impairment. In cats, benazeprilat is eliminated principally (~85%) by the bile, and no dose adjustment is necessary for moderate renal insufficiency. ACEIs reduce glomerular capillary pressure, inhibit renal cellular growth, and reduce glomerular capillary permeability to protein, resulting in attenuation of proteinuria and prevention of glomerulosclerosis. ACEI are considered maintenance (not acute) therapies, with their onset of action within several hours of administration. Dose: 0.5mg/kg S-BID (dog / cat)

Telmisartan: Telmisartan is an AT-II receptor blocker (ARB). By selectively blocking AT-I receptor, aldosterone synthesis and secretion is reduced causing vasodilation and decreased potassium and increased sodium excretion. Dose: 1mg/kg SID (dog / cat)

Spironolactone: antagonist of aldosterone that works within distal tubule and is potassium-sparing. Aldosterone has direct effects on the vasculature and has been associated with vascular smooth muscle hypertrophy, endothelial dysfunction, cardiac fibrosis, proteinuria, and renal vascular injury. Spironolactone has been shown to decrease proteinuria and glomerulosclerosis. It is usually the 3rd drug added to antihypertensive regimin in dogs and cats. If an adrenal mass is suspected to contribute to hypertension, it is prescribed immediately. Dose: 1-2mg/kg S-BID (dogs / cats)

Patients with certain underlying diseases are at increased risk of developing hypertension, so diagnostic efforts should focus on a specific population of patients. Patients with increased risk of developing hypertension and warrant blood pressure screening include:

- Hyperadrenocorticism
- Renal disease
- Thyroid disease
- Diabetes mellitus
- Pheochromocytoma
- Hyperaldosteronism
- Chronic anemia
- Medications (erythropoietin supplementation, steroids)

In all patients, doses are starting points and individual animals may vary in their response. Blood pressure should be monitored closely in the initial phases of therapy, especially if the underlying disease has not yet been controlled. Once the patient's condition and blood pressure have stabilized at target levels, routine rechecks approximately every three months are recommended (with more frequent rechecks if the patient's condition is not stable).

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24/7 video telehealth services provided by experienced, US-based veterinarians that triage client-perceived pet emergencies. Connect in minutes, no software downloads or appointments needed, connect in minutes in 3 easy steps from any computer or mobile device.

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VetTriage services are offered at **no cost to your clinic!** The client pays a small triage session fee to video chat with our veterinarians. Save money by eliminating the need for an after-hours answering service, whom are not medically trained and a source of frustration for the client.

Maintain Veterinary Quality of Life

Eliminate the need for a veterinarian or technician to be on-call after-hours and overnights. This has shown to **substantially improve recruitment efforts** for new vets and technicians for clinic partners.

Cases are Triaged for Actual Emergencies

Nearly 80% of cases do not require a visit to the ER and the unnecessary expense associated with it. These cases are given advice and are re-directed back to the clinic for follow-up, diagnostics, and treatment. While actual emergencies are sent to the ER for immediate evaluation.

Your Cases Stay Your Cases

VetTriage is a **seamless extension of your clinic**, and are recommended to follow-up with you, their primary veterinarian. A session summary is emailed to both your office and your client allowing you to reference their triage session and insert it into the medical records.

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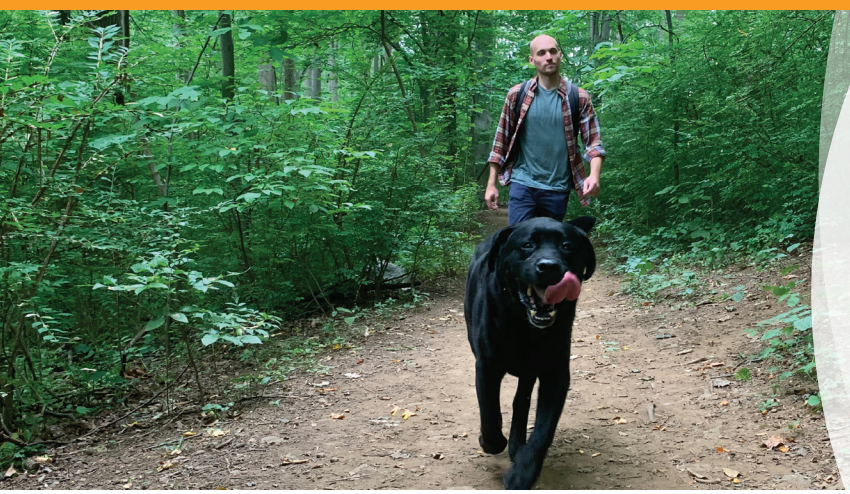
Instill comfort in your current clientele that a reliable and experienced telehealth service is available during times of limited office hours and for emergency triage during after-hours, overnights, and holidays.

For more information contact our medical director Shadi Ireifej, DVM, DACVS at (845) 527-9812 or shadi.ireifej@vettriage.com

A revolution in chronic elbow OA pain management



Synovetin OA®

1 simple treatment relieves OA pain up to 1 full year.

For easy, enduring relief of chronic OA pain, use Synovetin OA.

- **Long-lasting relief:** Up to 1 full year of OA pain relief
- **Consistent effectiveness: 92%** (12/13) in mild to moderate elbow OA[1], **71%** (10/14) in severe[2]
- **Non-systemic:** No systemic adverse effects[3]
- **Convenient:** 1 simple, targeted procedure

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1. Aulakh KS, Lopez MJ, Hudson C, et al. Prospective clinical evaluation of intra-articular injection of tin-117m (117mSn) radiosynoviorthesis agent for management of naturally occurring elbow osteoarthritis in dogs: A pilot study. Veterinary Medicine: Research and Reports. 2021;12:1-12.
2. Donecker J, Fabiani M, Gaschen L, Aulakh KS. Treatment response in dogs with naturally occurring grade 3 elbow osteoarthritis following intra-articular injection of Sn (tin) colloid. PLoS ONE. 2021;16(7). e0254613.https://doi.org/10.1371/journal.pone.0254613.
3. Lattimer JC, Selting KA, Lunceford JM, et al. Intraarticular injection of a Tin-117m radiosynoviorthesis agent in normal canine elbows causes no adverse effects. Vet Radiol Ultrasound. 2019:1-8. doi: 10.1111/vru.12757.

Homogeneous Tin (^{117m}Sn) Colloid] Veterinary Device for Use in Dogs

NAME: Synovetin OA®

Tin (^{117m}Sn) stannic colloid in ammonium salt. It is supplied as a 2–4 mCi (74–148 MBq)/mL suspension for intra-articular (IA) injection.

NET QUANTITY

Vials contain a prescribed dose up to 6.0 mCi (222 MBq) at the date and time to treat one dog.1 mL of suspension contains 2–4 mCi (74–148 MBq) of tin (^{117m}Sn) stannic colloid in ammonium salt at the date and time of end use.

PRODUCT DESCRIPTION

Synovetin OA® is a conversion electron therapeutic veterinary device comprising a colloidal, sterile suspension with a pH between 6.5 and 9.0 where at least 90% of the particles have a size between 1.5 µm and 20 µm (HORIBA light scatter instrument). The ^{117m}Sn emits monoenergetic conversion electrons (significant energies 127–158 keV; emission probability 113%) and imageable gamma radiation (159 keV, 86% abundant). Accompanying low-energy emissions are Auger electrons (<22 keV) and X-rays (<30 keV). The half-life of ^{117m}Sn is 14 days. 117mSn decays by isomeric transition to stable ^{117}Sn.

Excipients include ammonium carbonate ($(NH_4)_2CO_3$), ammonium chloride (NH_4Cl), ammonium iodide (NH_4I), iodine (I_2) and trace tin (Sn) salts.

MECHANISM OF ACTION

Synovetin OA® is a veterinary device consisting of a homogeneous tin colloid which emits discrete (<300 µm) low-energy conversion electrons confined to the joint space. The colloid is composed of microparticles (1.5 µm to 20 µm) that are retained in the joint space of the dog. The particles are absorbed and retained by synoviocytes and macrophages in the synovium, resulting in apoptosis and reduction of inflammatory cells. Elimination of the pro- inflammatory cells reduces inflammation of the joint synovium, thereby reducing pain associated with synovitis. The data, including radiographic evidence, supports use in Grade 1, 2, and 3 osteoarthritis (OA) of the elbow joint.

CAUTION

Federal law restricts this device to sale by or on the order of a licensed veterinarian trained in the use of radioactive veterinary medical products. Use of this product is restricted to facilities with a compatible Radioactive Materials (RAM) license.

INTENDED USE

Synovetin OA® is intended to reduce synovitis and associated pain of canine elbow joints afflicted with osteoarthritis.

WARNINGS

Do not exceed 6.0 mCi (222 MBq) of radiation activity per dog per treatment. Not for use in humans. Keep this and all medications out of reach of children. Consult a physician in case of accidental injection or ingestion by humans.

PRECAUTIONS

Injection should be performed only by a licensed veterinarian skilled in the delivery of intra-articular (IA) injections who is located at a facility that has a RAM license.

Rigorous aseptic technique must be ensured during injection

ROUTE OF ADMINISTRATION

Intra-articular injection. The product must NOT be administered by any other route. Confirmation of needle placement is recommended, whether by anatomical landmarks, fluoroscope, C-arm, ultrasound, or radiography.

DIRECTIONS FOR ADMINISTRATION

Dogs should be appropriately anesthetized or deeply sedated prior to administration to prevent vocalization and resistance to dosing. A 22-ga. needle can be used to inject Synovetin OA® directly into the elbow joint. Pain during and after treatment may occur. Administration of non-steroidal anti-inflammatory agents at the labeled dose may help any post-treatment pain.

FREQUENCY OF ADMINISTRATION

If needed, Synovetin OA® can be readministered to a previously treated elbow at least 12 months after the last treatment.

DURATION OF EFFECT FROM ADMINISTRATION

Effectiveness has been shown to last up to 12 months following a single treatment of dogs with naturally occurring OA of the elbow.

MAXIMUM ANNUAL DOSE

Total radiation dose per joint should not exceed 3.0 mCi/joint, with the total body dose not exceeding 6.0 mCi (i.e., two elbow joints during a 12-month period).

ADVERSE REACTIONS

Dogs participating in clinical studies to evaluate safety and effectiveness (n=74 dogs, 97 elbow joints) exhibited no significant adverse reactions when administered Synovetin OA®. Discomfort in the treated elbow has been rarely reported in some dogs up to 72 hours after treatment. If adverse events are observed or suspected, please report them by calling Exubrion Therapeutics® Customer Service at 1-833-942-1247.

POST-INJECTION CARE

Following administration of Synovetin OA®, the dog can recover with other post-operation animals in the general clinic population. Once the dog has fully recovered from anesthesia, it can be discharged to go home with the approval of the facility radiation safety officer or authorized user. All treatment site policies and license requirements should be observed.

OWNER INSTRUCTIONS FOR POST-TREATMENT CARE

When the level of radiation is determined to be below the established levels for release, the dog can be discharged. The dog will, however, retain a low level of radioactivity in the treated joint(s) for a short period of time. Specific written instructions based on the post-treatment radiation dosimetry for care and proximity to the treated dog will be provided by the radiation safety officer (RSO) or authorized user (AU) of a radioactive materials (RAM)-licensed veterinary hospital to the dog owner. These instructions include information on limiting proximity to the dog in the post-treatment period. If in the judgement of the veterinarian, the dog owners are not likely to comply with the release instructions, the product should not be administered. A RAM-licensed veterinary hospital RSO or AU should contact Exubrion Therapeutics® if there are specific questions. Apart from the proximity requirements to protect people there is no requirement for restraint of the dog itself, and it can resume its normal level of activity subject to the distance requirements.

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STORAGE INSTRUCTIONS

Store in the shipping container at controlled room temperature (10°–30°C or 50°–86°F) until ready to use.

EXUBRION THERAPEUTICS

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INTEGRATIVE TREATMENT MODALITIES IN SMALL ANIMAL VETERINARY NEUROLOGY

Review of the literature and suggestions for implementation in clinical practice – Part I

Patrick F. P. Roynard, DVM, MSc, MRCVS, DACVIM (Neurology), certified disk arthroplasty surgeon

INTRODUCTION

Neurological disorders are common amongst companion animals, and some of the most frequently encountered are myelopathies (e.g. intervertebral disc disease [IVDD]) and seizure disorders. Clinical neurology has markedly changed in the past few decades with the spread of advanced imaging such as magnetic resonance imaging (MRI), often pre-requisite to an accurate diagnosis for disorders of the central nervous system (CNS). Conventional treatments for neurological disorders can be broadly divided into medical and surgical interventions, with decompression of the CNS being one of the goals in many cases of surgical management (e.g. decompression of the spinal cord for IVDD, tumor removal and decompression of the brain parenchyma for brain tumors such as meningiomas). Various "alternative" treatment modalities have been described in the management of small animal neurological disorders, often as an adjunct to standard medical care. Some of these modalities, such as acupuncture and physical rehabilitation for spinal cord injuries (SCI), have already been investigated in several clinical studies and are relatively well-established practice at this time. This text does not aim at being exhaustive but rather presenting the integrative modalities most commonly used and documented in small animal neurological disorders, along with suggestions for their implementation.

MYELOPATHIES

ACUPUNTURE

Spinal cord injury (SCI)

Modern neuroscience has established the importance of secondary injury in spinal cord injuries (SCIs), with calcium entry in neuronal cell bodies, axons, astrocytes, and oligodendrocytes resulting in a cascade of cytokines and free radicals released by activated microglia and damaged mitochondrial membranes (Olby 2010, Jeffery et al 2013). Pro-inflammatory cytokines and mediators, such as tumor necrosis factor α (TNF-α), interleukin-1β (IL-1β), matrix metalloprotease-9 (MMP-9) and nitric oxide (NO), promote the inflammatory-cascade, neuronal and oligodendrocyte damage, which leads to demyelination of axons and progressive disruption of nervous tissue. Long-term consequences of neuronal inflammation are associated with the development of astrocytosis, glial scar formation and syringohydromyelia, impairing the potential for recovery after SCI (Jeffery et al 2013, Olby & Jeffery 2012). No proven pharmacological protocol protective of these secondary changes is currently available in veterinary clinical practice, but acupuncture may have such effect according to modern research. An experimental study of SCI in rats with sham/placebo control showed that acupuncture significantly ($P<0.01$) improved functional recovery after SCI compared to control groups. Acupuncture treatment resulted in significantly ($P<0.01$) attenuated microglial activation and significantly reduced expression of TNF-α ($P<0.01$), IL-1β ($P<0.01$), IL-6 ($P<0.01$), MMP-9 ($P<0.05$), NO synthase ($P<0.001$) and cyclooxygenase-2 ($P<0.001$), providing neuroprotection and reducing apoptotic cell death of both neurons and oligodendrocytes ($p<0.001$). Axonal loss and lesion size on immune-histochemical staining were also significantly decreased ($p<0.05$) with acupuncture (Choi et al 2010).

Neuroplasticity defines the ability of the nervous tissue to change structurally throughout life, both at a single cell level and at a neural network level (e.g. synaptic or non-synaptic plasticity), resulting in functional changes (e.g. synaptic strengthening or weakening, transfer of function from one cortical area to another). Prompted by neural changes, plasticity-factors are altered by trauma (or within the course of the neurologic disease), which can lead to structural modifications of the remaining neurons—strengthening their survival, and facilitating new neural networks. Specific neurotrophins, such as brain-derived neurotrophic factor (BDNF) and neurotrophic factor-3 (NT-3) are endogenous plasticity promoters that appear to stimulate neuronal cell survival, fortify synaptic connections, and may be key factors in recovery from SCI. These neurotrophins are down regulated in SCI (Spejo et Oliveira 2015)

and studies in SCI rodent-models suggest a positive correlation of BDNF and NT-3 levels with optimum functional neurologic recovery (Houle & Cote 2013, Ying et al 2008) and reduction in neuropathic pain (Hutchinson et al 2004). A study on a murine model of SCI reported neuro-protective effects of electro-acupuncture (EA) along with improved recovery of locomotor function, positively correlated with the up-regulation of BDNF and NT-3($P < 0.05$)(Tu WZ et al 2017).

Acupuncture for Intervertebral disc disease (IVDD)

In the traditional Chinese veterinary medicine (TCVM) paradigm, spinal cord injuries (SCIs) are due to Qi and Blood stagnation, and acupuncture has long been used for various disorders of the spinal cord.

Aside from the benefits for the spinal cord itself mentioned above, electro-acupuncture (EA) has also been shown to have effects on vertebrae and intervertebral discs likely to be beneficial in cases of IVDD. In a randomized controlled murine study, EA inhibited ¬¬Wnt-β-catenin, which may contribute to its effect in delaying the degenerative process of the cervical intervertebral discs (Liao et al 2014). Acupuncture can also reduce the amount of type I collagen in the nucleus pulposus while promoting type II collagen, necessary for the proper hydration of proteoglycans leading to compression resistance (Innes & Melrose 2015), therefore improving the ability of degenerated discs to repair (Wang et al 2009). In a rat model of IVDD, EA also increased vertebral blood flow, micro-vessel density, and the number of normal neurons in the spinal cord (Jiang et al 2015).

Multiple clinical studies have been published regarding the use of acupuncture in cases of canine IVDD (as sole therapy or with other modalities such as herbal or rehabilitation), either as an adjunct or as an alternative to standard medical or surgical management. While several studies present methodological flaws and researcher bias (groups not matched, evaluator not blinded), a trend towards faster, more complete recovery seems associated with EA, and some authors have concluded that EA may have a success rate of up to 83-95% in treating canine thoracolumbar (TL) IVDD (Janssens & De Prins 1989, Janssens 1983, McCaskill 2018). In one study on 50 dogs with signs of TL IVDD separated in 2 groups, receiving conventional medical treatment alone or conventional medical treatment with EA, the time to recover ambulation was significantly ($P=0.0341$) less (10.10 ± 6.49 days) in the group receiving EA than without EA (20.83 ± 11.99 days) for non-ambulatory dogs with intact nociception (grades 3 and 4 – see **Table 1** for neurological grades). The success rate, defined as the ability to walk without assistance, for grades 3 or 4 was significantly ($P=0.047$) higher with EA (10/10) than without EA (6/9). The overall success rate was significantly ($P=0.015$) higher with EA (23/26; 88.5%) than without EA (14/24; 58.3%) (Hayashi et al 2007).

In a retrospective study on 80 dogs with paraplegia and intact nociception from TL IVDD (grade 4), the combination of EA with prednisone was significantly ($P=0.01$) more effective than prednisone alone to recover ambulation, allowed faster return to ambulatory status ($P=0.011$), relieved back pain ($P=0.001$) and decreased relapse rate ($P=0.031$) (Han et al 2010). Another study compared EA, hemilaminectomy and hemilaminectomy + EA in 40 dogs with more than 48 hours of severe neurologic deficits due to IVDD (only grades 4 and 5) confirmed by diagnostic imaging (MRI, CT, myelography). "Clinical success", defined as a patient initially classified grade 4 or 5 being classified as grade 1 or 2 within 6 months of treatment, was significantly ($P<0.05$) higher for dogs that received EA alone (15/19 or 79%) or EA and surgery (8/11 or 73%) than for dogs that had surgery alone (4/10 or 40%) (Joaquim et al 2010).

Figure 1 10 YO FS Italian Greyhound receiving electro-acupuncture treatment for cervical, thoracolumbar and lumbar IVDD. Note the use of multiple leads with both truncal/local points (e.g. *Jing-jia-ji, Hua-tuo-jia-ji,* BL points) and appendicular/distal points (e.g. LI-4, LI-10, ST-36, GB-34).

TCVM can also be used for cervical IVDD and, in the authors' opinion, it may be one of the most rewarding conditions to treat with EA. A retrospective study describing the use of 3 different acupuncture protocols using dry needle acupuncture +/- EA and Chinese herbs (Jing Tong Fang [Cervical

Formula], modified Da Huo Luo Dan [Double P II] – proprietary Chinese herbal formulas manufactured by Jing Tang Herbal, Reddick, FL) in 19 dogs with cervical myelopathy having previously failed conventional medical/surgical management (18 with IVDD, 1 with fibro-cartilaginous embolic myelopathy) reported improvement from both a pain and neurological function standpoint in all 19 patients (Liu et al 2016). A case report also describes the successful use of EA and herbals for IVDD at C3-C4 in a miniature Pinscher (Hayashi et al 2007).

While the author still recommends advanced imaging and decompressive surgery when indicated for cases of presumptive IVDD (se Figure 1), these results justify offering EA as an adjunct in the "gold standard", whether the conventional management pursued is surgical or conservative. A suggested recommendation for the use of TCVM based on grading of neurological deficits is included in Table 1.

Table 1. Neurological grading scale commonly used in canine IVDD and suggested recommendation for use of TCVM & integrative modalities

0	Normal
1	**Cervical or thoracolumbar pain, hyperesthesia with no neurological deficits:** TCVM & other modalities (e.g. laser) as an adjunct, or alternative to standard management (activity restriction still recommended in acute/painful stage)
2	**Ataxia, paresis, decreased proprioception, ambulatory:** TCVM & other modalities (e.g. laser) ideally used as adjunct to standard management including rehabilitation (activity restriction still recommended in acute/painful stage)
3	**Paresis with absent proprioception, non-ambulatory:** TCVM & other modalities (e.g. laser), as an adjunct to standard management with recommendation for advanced imaging +/- decompressive surgery and rehabilitation
4	**Paralysis, nociception present:** TCVM as adjunct to standard management with recommendation for advanced imaging +/- decompressive surgery and intensive neuro-rehabilitation post-operatively (e.g. NMES, therapeutic exercises including land treadmill, laser)
5	**Paralysis, absent nociception:** Both TCVM, decompressive surgery and intensive neuro-rehabilitation post-operatively (e.g. NMES, therapeutic exercises including land treadmill, laser)

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