Congenital phimosis causing preputial swelling in a newborn foal

Scapula fracture secondary to metastatic pulmonary carcinoma in a horse: Clinical, sonographic, radiographic, computed tomographic, and pathologic findings

Canine retrobulbar lipoma excision through a ventral transpalpebral anterior orbitotomy

Cranial tibial fascia autograft for wound closure following hemipelvectomy in a cat

Intermittent urethral obstruction secondary to caudal sliding of a pelvic bladder in 3 dogs

Prescribing patterns and comparison of culture versus empiric-based selection of meropenem in cats and dogs in a veterinary teaching hospital (2011–2018)

Clinical findings, diagnoses, and outcomes of horses presented for colic to a referral hospital in Atlantic Canada (2000–2015)

Effectiveness of tapentadol hydrochloride for treatment of orthopedic pain in dogs: A pilot study

Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital

Recent and current clinical trials in canine appendicular osteosarcoma

Aortic thromboembolism in a basset hound-beagle crossbred dog with protein-losing nephropathy
Keep your clients coming back, for life

IDEXX Preventive Care
Everything you need to implement diagnostics, for a lifetime of healthy relationships

- IDEXX Preventive Care profiles
- Tools to get clients to yes
- Dedicated IDEXX team for implementation

Discover more at idexx.ca/PreventiveCare
Protect what matters, at exclusive rates. Insurance that works for you.

CVMA’s partnership with The Personal gives you access to exclusive home and auto insurance rates, not available to the general public. That’s group buying power at work.

Get a quote today.

thepersonal.com/cvma
1-888-476-8737

The Personal refers to The Personal Insurance Company. Certain conditions, limitations and exclusions may apply. Auto insurance is not available in MB, SK and BC due to government-run plans.

Protégez ce qui compte, à des tarifs exclusifs. L’assurance pensée pour vous.

Le partenariat entre l’ACMV et La Personnelle vous donne accès à des tarifs exclusifs, non offerts au grand public, pour vos assurances auto et habitation. C’est la force du groupe en action!

Demandez une soumission.

lapersonnelle.com/acmv
1 888 476-8737

La Personnelle désigne La Personnelle, compagnie d’assurances. Certaines conditions, exclusions et limitations peuvent s’appliquer. L’assurance auto n’est pas offerte au Manitoba, en Saskatchewan ni en Colombie-Britannique, où il existe des régimes d’assurance gouvernementaux.
The truth is, nothing else is “just like” FortiFlora®.

Powerful.
Promotes digestive and immune health.

Proven.
Backed by multiple clinical studies.

Proprietary.
No other canine or feline probiotic—generic or brand name—can use the strain *Enterococcus faecium* SF68®.

Demand the #1 probiotic brand recommended by veterinarians. Order today.

Questions about FortiFlora®?
Contact your Purina® Territory Manager at 1-866-884-VETS(8387).

† 2018 Veterinary Attitude Study, Impact Vet, Fall 2018
Contents Table des matières

SCIENTIFIC RUBRIQUE SCIENTIFIQUE

CASE REPORTS RAPPORTS DE CAS
247 Congenital phimosis causing preputial swelling in a newborn foal
Igor F. Canisso, Robyn E. Ellerbrock, Pamela A. Wilkins

251 Scapula fracture secondary to metastatic pulmonary carcinoma in a horse: Clinical, sonographic, radiographic, computed tomographic, and pathologic findings
Jannah Pye, Isabelle Kilcoyne, Melissa Roy, Betsy Vaughan, Carol Ormond, Mathieu Spriet

257 Canine retrobulbar lipoma excision through a ventral transpalpebral anterior orbitotomy
Lauren Charnock, Brianna Doran, Ellen Milley, Timothy Preston

263 Cranial tibial fascia autograft for wound closure following hemipelvectomy in a cat
Darren C. Barnes, Robert J. Quinn

267 Intermittent urethral obstruction secondary to caudal sliding of a pelvic bladder in 3 dogs
Caroline Benzimra, Magali Decôme, Christelle Maurey, Eddy Cauvin, Jérôme Couturier, Audrey Belmudes, Delphine Rault

ARTICLES
274 Prescribing patterns and comparison of culture versus empiric-based selection of meropenem in cats and dogs in a veterinary teaching hospital (2011–2018)
Lillian M. Cousto, J. Scott Weese, Shane W. Bateman

281 Clinical findings, diagnoses, and outcomes of horses presented for colic to a referral hospital in Atlantic Canada (2000–2015)
Jaclyn M. Kaufman, Omid Nekouei, Aimie J. Doyle, Nora M. Biermann

289 Effectiveness of tapentadol hydrochloride for treatment of orthopedic pain in dogs: A pilot study
Nina R. Kieves, James Howard, Phillip Lerche, Jeffrey Lakritz, Turi K. Aarnes

294 Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital
Frédéric Rousseau-Blass, Elizabeth O’Toole, Josée Marcoux, Daniel S.J. Pang

REVIEW ARTICLE COMPTE RENDU
301 Recent and current clinical trials in canine appendicular osteosarcoma
Andrew C. Poon, Arata Matsuyama, Anthony J. Mutsaers

STUDENT PAPER COMMUNICATION ÉTUDIANTE
309 Aortic thromboembolism in a basset hound-beagle crossbred dog with protein-losing nephropathy
Kathryn Gardiner

QUIZ CORNER TEST ÉCLAIR

FOR PERSONAL USE ONLY
SOME SEE BARRIERS
WE SEE
BREAKTHROUGHS

Prescription Diet c/d Multicare Stress is formulated to help prevent recurrences of FIC — so your patient can rejoin the family.

1. The ONLY nutrition shown in a controlled study to reduce the rate of recurring feline idiopathic cystitis (FIC) signs by 89%.

2. Dissolves struvite stones in as little as 7 days (average 27 days).

3. Added L-tryptophan and hydrolyzed casein to help manage stress, a known risk factor for FIC.

Ask your Hill’s territory manager about urinary nutrition that’s A STEP AHEAD FOR THEIR BEST LIFE.

©2020 Hill’s Pet Nutrition Canada, Inc. ®/™ Trademarks owned by Hill’s Pet Nutrition, Inc.
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>225</td>
<td>Climate Change</td>
<td>Michael Wilson</td>
</tr>
<tr>
<td>225</td>
<td>Climate Change – A response</td>
<td>Carlton Gyles</td>
</tr>
<tr>
<td>227</td>
<td>PRESIDENT'S MESSAGE</td>
<td>Melanie Hicks</td>
</tr>
<tr>
<td>229</td>
<td>VETERINARY MEDICAL ETHICS</td>
<td></td>
</tr>
<tr>
<td>313</td>
<td>Aural hematoma and it’s treatment: A review</td>
<td>Jennifer Hewitt, Jangi Bajwa</td>
</tr>
<tr>
<td>317</td>
<td>VETERINARY PRACTICE MANAGEMENT</td>
<td></td>
</tr>
<tr>
<td>321</td>
<td>DIAGNOSTIC OPHTHALMOLOGY</td>
<td>Bianca S. Bauer, Marina L. Leis, Lynne S. Sandmeyer</td>
</tr>
<tr>
<td>322</td>
<td>Index of Advertisers</td>
<td></td>
</tr>
<tr>
<td>323</td>
<td>Classifieds</td>
<td></td>
</tr>
<tr>
<td>233</td>
<td>NEWS NOUVELLES</td>
<td>Heather Broughton, Sophie Perreault</td>
</tr>
</tbody>
</table>

Contributors

“Instructions for authors” are available online (www.canadianveterinarians.net).

Whatever and wherever you practice, the CVMA is with you every step of your way.

We speak for you on veterinary issues of national importance and protect the integrity of our profession.

As a CVMA member, you benefit from...
- Engagement with Government and stakeholders to influence policy decisions
- International relations to provide the Canadian veterinary perspective
- Media/public relations to provide trustworthy information and promote veterinary professionals
- Position statements addressing animal welfare and national veterinary issues
- Member consultations on key veterinary issues
- Leadership initiatives on antimicrobial stewardship and surveillance, cannabinoids, telemedicine
- Administration of national veterinary exams to ensure uniform certification of professional credentials
- Accreditation of veterinary colleges and veterinary technician programs

We provide resources to help you achieve a meaningful career and personal wellness.

As a CVMA member, you benefit from...
- The Canadian Veterinary Journal
- The Canadian Journal of Veterinary Research
- Member e-newsletter ‘Online from 339’
- CVMA national convention and CE
- CVMA National Issues Forum
- CVMA Summit
- CVMA Emerging Leaders Program
- CVMA Canadian Veterinary Reserve
- LifeLearn products (preferred pricing)
- MyVetStore.ca™ CVMA web store solution for clinics
- Practice owner’s economic survey
- Individual practice diagnostic and valuation report
- Provincial suggested fee guide
- Associate compensation and benefits report
- Compensation report for non-DVM staff
- Compensation report for DVMs outside private practice
- Practice management articles and career/business resources
- CVMA specialized group insurance program
- CVMA mentoring program
- VetLaw Online™ legal advice column
- CVMA Green Veterinary Practice and self-audit tool
- Veterinary health and wellness resources
- Early career DVM resource hub
- Guidelines for the successful employment of new graduates
- Guidelines for the legitimate use of compounded drugs
- CVMA Guidelines for Veterinary Antimicrobial Use (online database)
- Therapeutic decision cascade poster
- Animal abuse resources for practitioners
- Preventive healthcare, nutritional assessment and client education tools and resources
- Animal Health Week, National Tick Awareness Month and Mental Health in Vet Med Awareness Week campaigns

We put money in your pocket to increase your profitability.

As a CVMA member, you benefit from...
- GoodLife Fitness (discount)
- CVMA Petcard™ Program – financing options for your clients
- Moneris™ payment processing services (preferred pricing)
- HRdownloads™ (discount)
- Mont Tremblant SkiMax/GolfMax (discount)
- Hotels worldwide discount program
- The Personal Insurance for home/auto/travel (preferred pricing)
- National and Enterprise car rental (discount)
- Scotiabank® business banking and lending solutions
- Classified ads in The CVJ (discount)
- Clinician’s Brief™ (free global digital edition)
- Plumb’s Veterinary Drugs™ (subscription discount)
- Staples Advantage™ business products
- Adtel® telephone hold service and digital signage (preferred pricing)
- Petro-Canada SuperPass™ fuel/diesel discount
- CVMA Annual Convention (registration discount)
- WSAVA World Congress and WVA Congress (registration discount)

Visit our website or contact us to learn how to get more value from your membership.
3 Questions to ask as you enter discussions with potential partners.

**NO. 01**

Is it the right culture fit for your team?

As you begin considering your options for selling your pet hospital business, it’s important to find a partner aligned with your values, respectful of the individuality of what you’ve built, and equipped to grow your business, while your team and culture remain intact.

Ask around to find out which buyers have the best reputation for caring for pets and the people who love them.

**NO. 02**

Are there flexible deal structures?

Because selling your pet hospital is such a personal decision, you’ll want to understand what types of options are available, and to what level they can tailor the terms to meet your needs.

**ASK IF THE BUYER CAN:**
- Make all cash offers with no finance contingency
- Offer Joint Venture partnerships for growth and flexibility
- Buy the real estate outright or lease from you

**NO. 03**

How comprehensive are the support services?

As you contemplate transitioning your business, you’ll want to know every aspect is covered. Seek out a partner with a dedicated team seasoned in marketing (including digital advertising and social media strategy), web development and hosting, client satisfaction surveys, IT, HR, accounting, taxes, legal and more.

Let’s talk. Connect with us at 888.767.7755 and info@nva.com or visit us at NVA.com.

NVA has over 800 partnerships in the US, Canada, Australia and New Zealand. Our passionate, visionary local pet resort and hospital leaders embody NVA’s unique entrepreneurial spirit. We’d be more than happy to talk through your questions and concerns.
Dear Editor,

It is with concern that I send you this email. It concerns the fact that the December 2019 issue of *The Canadian Veterinary Journal* is bookended by 2 articles about climate change. I agree that climate change is happening, but it has been happening since the Big Bang and will keep happening long after our species have left this planet.

After reading the 2 articles I went to the Government of Canada website and read their statement. There is a lot of conjecture about what climate change holds for us and though it is something we must be aware of, I do not think that the current hysteria is helping the population at large or young colleagues that are already reporting more stress and anxiety than a 62-year-old like me.

With warming we will see more vector-borne diseases, but with less cold respiratory diseases brought on by stress and exposure will get less. We must also be cognizant that there are interest groups, like wind turbine and solar panel producers, that fund and support climatologists. When I go to a veterinary lecture the lecturer must acknowledge conflict of interest if the company whose product is being discussed is financing their research or tenure. I would like to see the same with climatologists.

We must also remember that in Canada and most countries climatologists work for the Government. During the First World War a “personal tax” was implemented as a temporary measure and is still with us. A “carbon tax” is just what governments and bureaucrats want.

Sorry about the rant, but as a scientist who believes in double-blind studies, it irks me that conjecture by a body that cannot predict our weather 2 weeks ahead keeps beating the scientific drum.

Submitted by Michael Wilson BVSc (Pretoria-1981), MRCVS.

PS: The activists want to get rid of all herbivores in the North American landscape. When I look at a sick animal, I don’t just take its temperature, but also listen to its lungs, etc.

---

**Climate Change — A response**

I thank my colleague for taking the time to express his views on the editorial and brief commentary on climate change which appeared in the December issue of *The CVJ*.

We both agree that climate change is a reality, but we appear to have different views on what should be done in response to it. Although cycles of climate change have been around since the Big Bang, it is human activity which has been a major contributor in the recent past and there is an opportunity to make adjustments in those activities which affect the build-up of greenhouse gases in the atmosphere. I don’t believe that a call for individuals, organizations and governments to take steps to implement strategies for mitigation and adaptation should be considered hysteria. The deaths of massive numbers of wildlife, the loss of human life, and the air pollution caused by the recent bushfires in Australia should be a reminder of the seriousness of our present situation.

*Carlton Gyles*
Canada’s Most Trusted Insurance Program

A Specialized Insurance Program for the Canadian Veterinarian Industry

Join now and receive preferred member pricing on Commercial Insurance and Employee Benefits!

Available exclusively to members of the Canadian Veterinary Medical Association. The CVMA Insurance Program offers the most comprehensive and cost-effective insurance protection for you, your employees and your practice.
President’s Message
Le mot de la présidente

Moving our profession forward
Faire avancer notre profession

In the first 6 months of my presidency, I’ve had the pleasure of meeting members from every province. During this time, I’ve found that most members, and many non-members, are aware of the advocacy efforts that the CVMA participates in on behalf of Canadian veterinarians. These are instrumental in making improvements to the profession. I want to take the opportunity to highlight a few of our newer initiatives, as well as a few that aren’t as well known.

I’m proud of a more recent focus on mental health in veterinarians. A joint initiative with Merck to launch a national Mental Health Awareness week last September was well received. The vision? To come together as a community and have open conversations about mental health in Canadian veterinary medicine. It kicked off with live suicide awareness and prevention webinars in both French and English. Along with the webinars, the campaign included materials to raise mental health awareness and downloadable provincial and regional mental health resources for veterinarians. We’re continuing to host a webinar series called “Time to talk about veterinary mental health,” and I would encourage you to participate or watch the recordings. We all know that the work of veterinary professionals and paraprofessionals is rewarding but at times can be mentally fatiguing. As it was pointed out in the last webinar, we are striving to find an individualized balance.

One of the top priorities of the CVMA in the past 5 years has been antimicrobial resistance and the prudent use of antimicrobials. The Association has begun work on a 4-year project focused on enhancing veterinary antimicrobial stewardship and surveillance in Canada. The National Veterinary Oversight System for Antimicrobial Use (AMU) will see the expansion of the CVMA Antimicrobial Use Guidelines to include aquaculture and equine. If you haven’t yet checked out the CVMA Antimicrobial Use Guidelines, you can find them on the website. The project will also include the implementation of a sustainable AMU data collection capability that will use electronic prescription and dispensing information across the beef, poultry, and swine sectors. The data will serve to enhance antimicrobial stewardship and to provide information for national reporting on antimicrobial use.

Au cours des six premiers mois de ma présidence, j’ai eu le plaisir de rencontrer des membres de toutes les provinces, et j’ai constaté que la plupart des membres, et même de nombreux non-membres, sont au courant des efforts déployés par l’ACMV pour défendre les intérêts des médecins vétérinaires canadiens. Ces efforts sont essentiels pour faire progresser notre profession. Je veux profiter de l’occasion pour souligner quelques-unes de nos nouvelles initiatives, ainsi que quelques autres qui ne sont pas aussi connues.

Je suis fière de l’accent qu’on met de plus en plus sur la santé mentale chez les médecins vétérinaires. Notre initiative conjointe avec Merck pour organiser une semaine nationale de sensibilisation à la santé mentale en septembre dernier a été bien accueillie. Notre vision? Nous souhaitons que la communauté vétérinaire se réunisse et ait des discussions ouvertes sur la santé mentale en médecine vétérinaire au Canada. La semaine a débuté par des webinaires en direct sur la sensibilisation et la prévention du suicide donnés en français et en anglais. La campagne comprenait aussi du matériel de sensibilisation à la santé mentale et des ressources provinciales et régionales en santé mentale à télécharger. Nous continuons d’organiser une série de webinaires intitulée « Il est temps de parler de santé mentale en médecine vétérinaire » et je vous encourage à participer ou à visionner les enregistrements. Nous savons tous que le travail en médecine vétérinaire est gratifiant, mais peut parfois être accablant. Comme cela a été souligné lors du dernier webinar, il faut s’efforcer de trouver un équilibre.

L’une des principales priorités de l’ACMV au cours des cinq dernières années a été la question de la résistance aux antimicrobiens et l’utilisation prudente des antinicrobiens. L’Association a commencé à travailler sur un projet de quatre ans axé sur l’amélioration de la gestion responsable des antimicrobiens et la surveillance vétérinaire de l’utilisation des antimicrobiens au Canada. Le Système national de surveillance vétérinaire de l’utilisation des antimicrobiens verra l’élargissement de la portée des lignes directrices sur l’utilisation des antimicrobiens de l’ACMV pour inclure l’aquaculture et les chevaux. Si vous n’avez pas encore consulté ces lignes directrices, vous pouvez les trouver sur

Use of this article is limited to a single copy for personal study. Anyone interested in obtaining reprints should contact the CVMA office (hbroughton@cvma-acmv.org) for additional copies or permission to use this material elsewhere.

L’usage du présent article se limite à un seul exemplaire pour étude personnelle. Les personnes intéressées à se procurer des réimpressions devraient communiquer avec le bureau de l’ACMV (hbroughton@cvma-acmv.org) pour obtenir des exemplaires additionnels ou la permission d’utiliser cet article ailleurs.
There has been growing concern in many provinces about a potential workforce shortage, including both veterinarians and registered veterinary technicians. Although a few provinces have conducted studies or surveys investigating this matter, national data have been lacking. The CVMA is now conducting a national workforce study, in order to better understand the causes of the current perceived shortage of veterinarians, as well as to assess the likelihood of it being long-term or more transitory in nature. We will also develop a model that can assist our members and other stakeholders in the veterinary community in determining future needs for veterinarians. The results of this study will be available in early 2020.

Some may not realize, but the CVMA has a student representative in all 5 Canadian veterinary schools, as well as within some international schools. Students have access to all materials found on the website, including position statements and antimicrobial use guidelines, that are helpful in their academic journey. They receive a printed copy of The CVJ, and organize an annual symposium sponsored by the CVMA. This year’s symposium was hosted by the Western College of Veterinary Medicine, and I was excited about the opportunity to interact with students from our 5 schools in one setting. The CVMA also hosts an annual “One Voice” discussion, which is a platform to engage with students on topics of national interest. We’ve had healthy debates in the last few years on the topics of onychectomy, rodeos, and the use of cannabinoids in animals.

Lastly, the Animal Welfare Committee and National Issues Committee work tirelessly to advance position statements that lead to positive changes for the benefit of animals, society and veterinary professionals. The CVMA Council recently approved a revised position statement on complementary and alternative veterinary medicine, as well as a position statement on elective and non-therapeutic veterinary procedures for cosmetic or competitive purposes. Our committees are working on a new position statement about service animals and are revising many others. Feedback from members is extremely important when these are sent for member comment, and I would encourage you to take the time to voice your opinion.

These are a few highlights from later 2019. I want to thank the hundreds of volunteers who contribute to the provincial and national initiatives that move our profession forward.

Melanie Hicks
A “sometimes” client calls you to investigate an outbreak of sudden death in a herd of commercial cows after they were moved to a fresh pasture 2 weeks ago. Seven cows have died over the last week. There are 2 dead and decomposing cows for post-mortem examination. Your gross post-mortem is not diagnostic; however, the owner does not want any samples taken for fear the results could damage the reputation of his herd. The deaths stopped when the cattle were moved to another pasture. You suspect a toxicosis but can find no obvious toxic plants or substances in the pasture where the deaths occurred. The disease investigation would be fully subsidized through funding for academic disease investigations; however, the producer wants his right to client confidentiality protected and no diagnostic tests performed. You are concerned that if a toxic substance is in the pasture that it could affect food safety or the health of other animals that may graze that pasture in the future. How should you respond?

If ethical behavior were always rewarding and easy, far more people would be ethical far more often. This is a case in which a client ignores ethics out of self-interest, plain and simple. He has already lost 7 cows in 1 week to the mysterious toxicosis. While it does not indicate in the case whether the pasture in question is owned by the client or was simply rented, there does not seem to be a moral difference between the situations. In either case, failure to track down the source of the poisoning is very likely to poison additional animals or affect the safety of the milk produced.

But the client fails to worry about these possibilities — he is concerned only about “the reputation of his herd.” To a veterinarian, however, the pasture as a source of poisoning ought to be of far greater importance. The potential for other animals getting sick and dying is without limits. People getting sick from drinking the milk produced on that pasture or consuming other products derived from the milk is a very real possibility. For the veterinarian not to act, violates his or her obligations to animals and the prevention of disease; to preventing animal suffering; to human consumers; and to the unlimited number of producers who might utilize the pasture in the future. In other words, many of the fundamental veterinarian’s obligations to animals, society, future producers, and human health are in peril. Since, as I have often remarked, a veterinarian’s primary obligation is to the animal or animals under his aegis, this concern should clearly come first.

This is a clear-cut moral situation which, in my mind, admits of no ambiguity. The veterinarian needs to explain to the client the unambiguous nature of the moral issue involved. One would hope, albeit it is a slim hope, that the client would be receptive to the argument we have advanced, and not persist in trying to avoid the truth. On the other hand, it is in his own interest that it not be known that he was aware of the problem and tried to conceal it.

An ethicist’s commentary on poisoned cows

Use of this article is limited to a single copy for personal study. Anyone interested in obtaining reprints should contact the CVMA office (hbroughton@cvma-acmv.org) for additional copies or permission to use this material elsewhere.

L’usage du présent article se limite à un seul exemplaire pour étude personnelle. Les personnes intéressées à se procurer des réimpressions devraient communiquer avec le bureau de l’ACMV (hbroughton@cvma-acmv.org) pour obtenir des exemplaires additionnels ou la permission d’utiliser cet article ailleurs.
Ethical question of the month — March 2020

A new client brings you a mature, mixed breed “rescue” dog she has recently acquired. She requests a complete physical examination and “all the necessary shots.” As you reach to examine the dog, it snarls and lunges at you. You muzzle the dog to examine it and give it the initial series of vaccines. The owner replies that that dog is very nervous around strangers, does not like men, and snapped at the next-door neighbor. You suggest she take the dog to an animal trainer/behavioralist as you are concerned the dog could seriously injure someone. Two weeks later the woman returns for the booster vaccinations and the dog’s behavior is still strongly aggressive. Six months later she returns for a heartworm check and once again the dog needs to be muzzled. She tells you the animal behavioralist gave up on the dog and recommended euthanasia. She is sure the dog will settle down with time, although it has attacked 2 other people since her last visit. Does your oath to protect public health include reporting this dog to the authorities?

Responses to the case presented are welcome. Please limit your reply to approximately 50 words and forward along with your name and address to: Ethical Choices, c/o Dr. Tim Blackwell, 6486 E. Garafraxa, Townline, Belwood, Ontario N0B 1J0; telephone: 519-846-3413; fax: 519-846-8178; e-mail: tim.e.blackwell@gmail.com

Suggested ethical questions of the month are also welcome! All ethical questions or scenarios in the ethics column are based on actual events, which are changed, including names, locations, species, etc., to protect the confidentiality of the parties involved.

Question de déontologie du mois — Mars 2020

Une nouvelle cliente vous emmène un chien adulte de race croisée qu’elle a récemment adopté. Elle demande un examen physique complet et « tous les vaccins nécessaires ». Lorsque vous vous approchez du chien pour l’examiner, il grogne et bondit vers vous. Vous lui mettez une muselière pour l’examiner et lui donner la première série de vaccins. La propriétaire vous mentionne que le chien est très nerveux en présence d’étrangers, qu’il n’aime pas les hommes et qu’il a essayé de mordre son voisin. Vous lui suggérez de consulter un comportementaliste ou un éducateur canin, car vous craignez que le chien puisse blesser quelqu’un. Deux semaines plus tard, le chien est de retour pour les vaccins de rappel et son comportement est toujours très agressif. Six mois plus tard, il revient pour le dépistage de la dirofilariose et, encore une fois, il doit être muselé. La propriétaire vous dit que l’éducateur canin a abdiqué et lui a recommandé l’euthanasie. Elle est convaincue que le chien va se calmer avec le temps, même s’il a attaqué deux autres personnes depuis sa dernière visite. Pouvez-vous devoir dénoncer la santé publique conformément au code de déontologie de la profession, êtes-vous tenu de dénoncer ce chien aux autorités?

Les réponses au cas présenté sont les bienvenues. Veuillez limiter votre réponse à environ 50 mots et nous la faire parvenir par la poste avec votre nom et adresse à l’adresse suivante : Choix déontologiques, a/s du Dr Tim Blackwell, 6486, E. Garafraxa, Townline, Belwood (Ontario) N0B 1J0; téléphone : 519-846-3413; télécopieur : 519-846-8178; courriel : tim.e.blackwell@gmail.com

Les propositions de questions déontologiques sont toujours bienvenues! Toutes les questions et situations présentées dans cette chronique s’inspirent d’événements réels dont nous modifions certains éléments, comme les noms, les endroits ou les espèces, pour protéger l’anonymat des personnes en cause.
1. Which of the following statements about amphotericin B is correct?
   A. It is an azole antifungal that blocks the synthesis of ergosterol.
   B. It is the treatment of choice for aspergillosis.
   C. The lipid-complex formulation is the more toxic formulation.
   D. Administration is limited to oral dosing.
   E. A significant side effect is nephrotoxicity.

2. In canines, the normal range for intraocular pressure (IOP) is which of the following?
   A. 10 to 15 mmHg
   B. 15 to 25 mmHg
   C. 20 to 30 mmHg
   D. 15 to 35 mmHg

3. This organism is considered to be the most common cause of human foodborne bacterial diarrheal disease in Canada. It can be an animal pathogen and can cause an unusual complication known as Guillain-Barré syndrome in humans. This organism is which of the following?
   A. Bacillus cereus
   B. Clostridium perfringens
   C. Campylobacter jejuni
   D. Salmonella Newport
   E. Staphylococcus aureus

4. Which of the following is the test of choice for diagnosis of pars intermedia dysfunction?
   A. Resting T4 level
   B. Resting cortisol level
   C. Dexamethasone suppression test
   D. Histopathology

1. Lequel des énoncés suivants à propos de l’amphotéricine B est exact?
   A. C’est un antifongique azolé qui bloque la synthèse de l’ergostérol.
   B. C’est le traitement de choix contre l’aspergillose.
   C. L’amphotéricine B en complexe lipidique est la préparation la plus toxique.
   D. L’administration est limitée à la voie orale.
   E. La néphrotoxicité est un effet secondaire indésirable significatif de l’amphotéricine B.

2. Quelle est la pression intraoculaire normale chez le chien?
   A. De 10 à 15 mmHg
   B. De 15 à 25 mmHg
   C. De 20 à 30 mmHg
   D. De 15 à 35 mmHg

3. Cet organisme est considéré comme étant la cause la plus commune de maladie diarrhéique bactérienne d’origine alimentaire au Canada. Il peut être un agent pathogène pour les animaux et peut provoquer une complication connue sous le nom de syndrome de Guillain-Barré chez les humains. De quel organisme s’agit-il?
   A. Bacillus cereus
   B. Clostridium perfringens
   C. Campylobacter jejuni
   D. Salmonella Newport
   E. Staphylococcus aureus

4. Laquelle des épreuves suivantes constitue le test de prédilection pour le diagnostic de la dysfonction du lobe intermédiaire de l’hypophyse?
   A. Taux de T4 au repos
   B. Taux de cortisol au repos
   C. Test de suppression par la dexaméthasone
   D. Histopathologie
5. A dairy cow is re-presented 24 hours after a standing laparotomy for correction of a left displaced abomasum. The complaint is extensive incisional and sublumbar subcutaneous emphysema. There are no other problems found. Which of the following is the likely diagnosis?

A. Bovine respiratory syncytial viral infection  
B. Abomasal perforation  
C. Peritonitis  
D. Clostridial myositis  
E. Escape of entrapped operative intraperitoneal free air

(See p. 262 for answers./Voir les réponses à la page 262.)
Council Update
November 2019 Council Meeting
Mise à jour du Conseil
Réunion du Conseil de novembre 2019

CVMA Council meets annually in November to review the CVMA’s achievements over the past year, to approve programs and budgets for the following year, and make policy decisions as required. The following are a few highlights:

CVMA Council members: CVMA Council consists of representatives of CVMA members in all provinces, the veterinary colleges, student veterinarians, and registered veterinary technicians. As of January 2020, CVMA Council consists of the following members:

Dr. Melanie Hicks, president
Dr. Enid Stiles (QC), president-elect
Dr. Louis Kwantes (AB), vice-president
Dr. Christopher Bell (MB), executive member
Dr. Terri Chotowetz, immediate past-president
Dr. Brian Evans, treasurer (ex officio)
Mr. Jost am Rhyn, chief executive officer (ex officio)
Dr. Christiane Armstrong (BC)
Dr. Timothy Arthur (ON)
Dr. Marie-Claude Blais (FMV/AVC)
Dr. Margaret Brown-Burry (NL)
Dr. Tracy Fisher (SK)
Dr. Trevor Lawson (NS)
Dr. Erin MacDonald (PE)

Mr. Steven Sternthal from the Public Health Agency of Canada attended the CVMA Council meeting.

Mr. Steven Sternthal de l’Agence de la santé publique du Canada a assisté à la réunion du Conseil de l’ACMV.

CVMA President, Dr. Melanie Hicks, right, with departing Council member Dr. Karen Machin.

La Dre Melanie Hicks, présidente de l’ACMV, à droite, avec la Dre Karen Machin, membre sortante du Conseil.
Dr. Liane Nelson (NB)
Dr. Karin Orsel (UCVM/WCVM/OVC)
Ms. Audrey Roy (SCVMA president)
Ms. Lois Ridway (RVTTC) (ex officio)

Dr. Karin Machin, representative of the Western College of Veterinary Medicine, University of Calgary Faculty of Veterinary Medicine, and the Ontario Veterinary College stepped down at the end of her term. The CVMA would like to thank her for her dedication and participation in the Council business.

Membership: With almost 7600 members and 8400 affiliated veterinary technicians, the CVMA has reached an all-time high in membership. What’s new? Keep watch for the video clips of your Council members articulating the value of membership.

Strategic plan: The CVMA is applying its new 2020–2022 strategic directions to the operational plan. As we heard from our members, student members, and non-members, the focus over the next 3 years will be on providing leadership and advocacy on national and international veterinary issues and animal welfare, engaging membership and the veterinary community, and promoting meaningful careers and personal wellness for veterinary professionals.

Labor market study: The CVMA is conducting a labor market study. This study is based on economic research and the objective is to identify past and future veterinary labor market trends for the purpose of potential adaptation by veterinary professionals.

La Dre Andrea Ellis de l’Agence canadienne d’inspection des aliments s’adresse au Conseil.

深层的医学

由于医学和技术的快速发展，医学实践者应了解和考虑新的趋势。这些趋势是为了未来的职业发展考虑的。CVMA的目的在于识别过去的和未来的职业劳动市场的变化。

该研究基于经济研究，并着眼于评估过去和潜在的未来职业趋势。这将有助于专业人员制定战略方向，并参与未来的职业规划。

战略计划：CVMA正在其2020-2022年新战略方向中应用其战略方向。正如我们从成员、学生成员和非成员中听到的，接下来的3年将聚焦于提供领导力和倡导，以解决国家和国际上的兽医事务和动物福利问题，激发会员参与和社区联系，并为兽医专业人士提供有意义的职业和个人健康。

劳动力市场研究：CVMA正在进行劳动力市场研究。该研究基于经济研究，目标是识别过去和未来的兽医劳动力市场趋势，从而为潜在的适应提供依据。
practices and the planning of veterinary capacity (e.g., education funding needs, and immigration needs).

**Antimicrobial use (AMU):** The CVMA obtained a funding contribution from the federal government for the development of the National Veterinary Oversight System for Antimicrobial Use (NVOS), a multi-year project through to March 2023. This project includes surveillance, stewardship and communications/knowledge transfer activities focusing on veterinary prescription and feed-mill dispensing for beef, swine, poultry, and enhancement to the CVMA Veterinary AMU Guidelines for beef, swine, poultry, dairy, equine, aquaculture, small ruminants, and companion animals. The project will employ data and knowledge to support informed decision-making, and enhance antimicrobial stewardship for companion and large animals.

**Cannabinoid products:** Along with the federal government, the CVMA continues to advance our previously suggested changes to regulations as follows: a) Permitting veterinarians to be listed as medical practitioners in the Cannabis Act and, therefore, be able to grant medical access to cannabinoids for patients; b) Safety of edibles and topicals for pets (recommend new warning labels).

The CVMA also continues to monitor the impact of legalization of cannabis on veterinarians and patients, and provide pertinent information to members, while keeping in communication with Health Canada.

**Complementary and Alternative Veterinary Medicine:** Council approved the following position statement:

> "The Canadian Veterinary Medical Association (CVMA) holds that the treatment of animals using complementary and/or alternative therapies and modalities, constitutes the practice of veterinary medicine. In addition, the CVMA holds that complementary or alternative veterinary medicine (CAVM) should be subject to similar standards as conventional veterinary medicine. Safety and efficacy should be demonstrated by scientific method and evidence-based principles and the practice of CAVM should be provided within the context of a valid veterinary-client-patient relationship (VCPR)."

**Telemedicine:** The CVMA National Forum on Telemedicine in July 2019 was well-attended and generated good discussions. Further review of the 2014 CVMA position statement is on hold pending regulatory guidance from the Canadian Council of Veterinary Registrars (CCVR).

**Veterinary surgical procedures:** A working group has been formed and revision of the current position statement is under way.

**Lyme disease:** CVMA continues to participate in the Lyme disease roundtable led by the Public Health Agency of Canada (PHAC). This has led to a proposed collaboration between PHAC and CVMA on raising awareness of tickborne zoonotic diseases, in addition to activities during Tick Awareness Month (March).

**National Tick Awareness Month** — a practical One-Health initiative: For the 4th year, the CVMA in partnership with Merck Animal Health, delivered the National Tick Awareness Month with the objective of raising public awareness on the most

**Médecine vétérinaire complémentaire et parallèle :** Le Conseil a approuvé l’énoncé de position suivant :

> « L’Association canadienne des médecins vétérinaires (ACMV) estime que le recours à la médecine complémentaire et/ou parallèle pour soigner les animaux constitue l’exercice de la médecine vétérinaire. De plus, l’ACMV estime que la médecine vétérinaire complémentaire ou parallèle (MVCP) devrait être soumise aux mêmes normes que la médecine vétérinaire conventionnelle. L’efficacité et l’innocuité des traitements de MVCP devraient être démontrées par la méthode scientifique et des preuves factuelles, et l’exercice de la MVCP devrait se faire dans le contexte d’une relation vétérinaire-client-patient valide. »

**Télémédecine :** Le Forum national sur la télémédecine de l’ACMV qui a eu lieu en juillet 2019 a attiré de nombreux participants et a suscité de bonnes discussions. Un examen plus approfondi de l’énoncé de position de l’ACMV publié en 2014 a été mis en suspens en attendant les directives réglementaires du Conseil canadien des registraires vétérinaires (CCRV).

**Interventions chirurgicales vétérinaires :** Un groupe de travail a été formé et la révision de l’énoncé de position actuel est en cours.

**Maladie de Lyme :** L’ACMV continue de participer à la table ronde sur la maladie de Lyme dirigée par l’Agence de la santé publique du Canada (ASPC). Cette participation a mené à une proposition de collaboration entre l’ASPC et l’ACMV sur la sensibilisation aux zoonoses transmises par les tiques, en plus des activités du mois de sensibilisation aux tiques (mars).

**Mois national de sensibilisation aux tiques –** une initiative pratique conforme à l’approche « Une santé » : Pour la quatrième année, l’ACMV a organisé en partenariat avec Merck Santé animale le Mois national de sensibilisation aux tiques dans le but de sensibiliser le public aux questions les plus pressantes sur les tiques et la maladie des tiques. Les groupes cibles étaient les propriétaires d’animaux, les médecins vétérinaires, les techniciens en santé animale et les médias. L’ACMV a beaucoup utilisé les médias sociaux et a fait la promotion de la campagne par l’entremise de La RVC, des associations vétérinaires provinciales, de l’industrie, de publications, d’infolettres et des médias. L’ACMV a lancé TiqueTocCanada.com, un nouveau site Web éducatif pour les propriétaires d’animaux de compagnie au Canada.


**Peste porcine africaine :** L’ACVM a offert à l’ACIA l’aide de la Réserve vétérinaire canadienne (RVC) en cas d’éclosion de peste porcine africaine (PPA). L’ACVM participe à un groupe de travail sur les communications concernant la PPA dirigé par l’ACIA et à un groupe de travail formé de représentants du gouvernement fédéral, des gouvernements des provinces et des territoires et
pressing questions about ticks and tick control. Target groups include pet owners, veterinarians, veterinary technicians and media. The CVMA relied heavily on social media and promoted the campaign through The CVJ, provincial veterinary associations, industry, publications, online newsletters and media. CVMA launched TickTalkCanada.com a new educational website for Canadian pet owners.

Importation of dogs: The CVMA, PHAC and the Canadian Food Inspection Agency (CFIA) met in mid-2019. A national ad hoc working group led by the CVMA is building on the 2016 report of the Council of Chief Veterinary Officers and identifying existing data and data gaps and drafting best practices for importers. Subsequent work may focus on awareness-building and stakeholder engagement.

African Swine Fever: The CVMA has offered the CFIA the assistance of the Canadian Veterinary Reserve (CVR) in case of an African Swine Fever (ASF) outbreak. The CVMA is involved in a CFIA-led ASF Communications Working Group and a Federal-Provincial Territorial-Industry Working Group, both of which consider depopulation related issues. Furthermore, the CVMA is working with the CFIA to provide access to a webinar on ASF and, with a broader stakeholder group, to stage a national disease outbreak exercise. The CVMA is also working with the Canadian Animal Health Coalition on the Animal Health Emergency Management Project for the promotion and delivery of Foreign Animal Disease/Foot and Mouth Disease (FAD/FMD) recognition and response training for private practitioners.

Service animals: The CVMA has conducted an environmental scan of service animal policies in governments and veterinary medical associations in the USA, UK, Australia and New Zealand. A position statement is scheduled to be submitted to CVMA Council for approval in March 2020.

Elective and Non-therapeutic Veterinary Procedures for Cosmetic or Competitive Purposes (formerly Cosmetic Alterations): Council approved the following position statement:

“The Canadian Veterinary Medical Association (CVMA) supports promotion of the natural appearance and conformation of animals and opposes non-therapeutic veterinary procedures for cosmetic or competitive purposes.”

National Examining Board (NEB): By the end of October 2019, a total of 389 internationally trained veterinarians had applied for registration with the NEB (379 in 2018, 310 in 2017, 258 in 2016). The NEB issued a total of 591 Certificates of Qualification (CoQ) (349 from Canadian colleges, 65 from international non-accredited colleges and 177 from international accredited colleges). In other words, 41% of recipients of a CoQ graduated from a veterinary college outside of Canada.

Council on Education (CoE): The CVMA has been part of the American Veterinary Medical Association CoE for many decades. The CVMA’s current CoE member is Dr. David Scammel. All Canadian veterinary colleges are AVMA/CVMA-CoE accredited. The CVMA representative also participates in all USA and international CoE accreditation site visits. In 2019, 10 accreditation site visits were conducted. In total, 50 veterinary colleges are currently accredited.

de l’industrie; ces deux groupes étudient les questions liées au dépeuplement. De plus, l’ACMV travaille avec l’ACIA pour donner accès à un webinaire sur la PPA et, avec un groupe d’intervenants plus large, pour organiser un exercice national d’éclosion de la maladie. L’ACMV collabore également avec la Coalition canadienne pour la santé des animaux dans le cadre du Projet de gestion des urgences sanitaires animales pour la promotion et la prestation d’une formation sur la détection et l’intervention en cas de maladie animale exotique ou de fièvre aphteuse pour les médecins vétérinaires en pratique privée.


Interventions vétérinaires électives et non thérapeutiques à des fins cosmétiques ou compétitives (anciennement Altération esthétique) : Le Conseil a approuvé l’énoncé de position suivant :

« L’Association canadienne des médecins vétérinaires (ACMV) appuie la promotion de l’apparence et de la conformité naturelles des animaux et s’oppose aux interventions vétérinaires non thérapeutiques à des fins esthétiques ou compétitives. »


Agrément des programmes de techniciens vétérinaires : Actuellement au Canada, 19 programmes de formation des techniciens vétérinaires sont agréés par l’ACMV.

Représentants du gouvernement fédéral : Durant la réunion de novembre, les invités ci-dessous ont fait des présentations et ont eu des discussions avec le Conseil de l’ACMV.

M. Steven Sternthal, directeur général du Centre des maladies infectieuses d’origine alimentaire, environnementale et zoonotique de l’Agence de la santé publique du Canada. M. Sternthal s’est concentré sur le plan d’action du gouvernement fédéral concernant la résistance aux antimicrobiens, les prochaines étapes et la participation de l’ACMV; la collaboration avec l’ACMV sur l’importation
Veterinary technician program accreditation: Currently, Canada-wide, 19 veterinary technician programs are CVMA accredited.

Federal government representatives: During its November meeting, the following guests made presentations to, and held discussions with CVMA Council:

Mr. Steven Sternthal, director general, Centre for Food-borne, Environmental and Zoonotic Infectious Diseases, Public Health Agency of Canada. Mr. Sternthal focused on the topics of the federal government’s antimicrobial resistance (AMR) Action Plan, the next steps and the involvement of the CVMA; the collaboration with the CVMA on importation of dogs; and collaboration with the CVMA on the 2020 National Issues Forum — One Health/Climate Change.

Dr. Andrea Ellis, veterinary science advisor to the World Organisation for Animal Health (OIE) delegate, CFIA. Dr. Ellis held a discussion with Council on such topics as African Swine Fever; the Canadian Veterinary Reserve and its value to the CFIA; alternatives to antimicrobials; and new developments on veterinary biologics.

Dr. Mary-Jane Ireland, director general, Veterinary Drugs Directorate (VDD), and Ms. Manisha Mehrotra, director, Human Safety Division, VDD, Health Canada. The discussions centered around updates on AMR and specific challenges during the transition, and concerns about potentially unintended consequences of increased drug approval fees.

2020 CVMA Committee members: Council has approved the following CVMA Committee members for the 2020 calendar year:

Animal Health Technology/Veterinary Technician Program Accreditation Committee
Dr. Jocelyn Forseille, Chair
Dr. Claudia Lister
Dr. Veronica Barkowski
Dr. Dale Cooper (AVMA)
Ms. Erin Young (RVTTC)
Ms. Heather Quilty (RVTTC)
Dr. Tracy Fisher, Council Liaison

Animal Welfare Committee
Dr. Patricia Alderson, Chair
Dr. Karen Allen
Dr. Michael Cockram
Dr. Ross Goodman
Dr. Anneliese Heinrich
Dr. Mike Petrlik
Dr. Emiko Wong
Dr. Timothy Arthur, Council Liaison
Dr. Liane Nelson, Council Liaison

Ex-officio Members
Dr. Marie-Odile Rozon (CFIA)
Ms. Gilly Griffin (CCAC)
Ms. Toolika Rastogi (Humane Canada)
Dr. Ted Kilpatrick (OVMA)
Dr. Marilyn Keaney (CALAM)
Dr. Bettina Bobsein (CVMA-SBCV Chapter)
Ms. Kate Cooper, RVT (RVTTC)

de chiens; et la collaboration avec l’ACMV pour le Forum de 2020 sur les enjeux nationaux sur le thème de l’approche « Une santé » et les changements climatiques.

D‘se Andrea Ellis, conseillère en sciences vétérinaires du délégué de l’Organisation mondiale de la santé animale (OIE), ACIA. La D‘se Ellis a eu une discussion avec le Conseil sur des sujets tels que la peste porcine africaine; la Réserve vétérinaire canadienne et sa valeur pour l’ACIA; des solutions de rechange aux antimicrobiens; et de nouveaux développements sur les produits biologiques vétérinaires.

D‘se Mary-Jane Ireland, directrice générale de la Direction des médicaments vétérinaires (DMV), et Mme Manisha Mehrotra, directrice de la Division de l’innocuité pour les humains de la DMV de Santé Canada. Les discussions ont porté sur des mises à jour concernant la résistance aux antimicrobiens et les défis spécifiques au cours de la transition, et les préoccupations concernant les conséquences potentiellement non intentionnelles de l’augmentation des frais d’approbation des médicaments.


Comité d’agrément des programmes de TSA/TV
D‘se Jocelyn Forseille, présidente
D‘se Claudia Lister
D‘se Veronica Barkowski
D‘se Dale Cooper (AVMA)
Mme Erin Young (TTVAC)
Mme Heather Quilty (TTVAC)
D‘se Tracy Fisher, agente de liaison avec le Conseil

Comité sur le bien-être animal
D‘se Patricia Alderson, présidente
D‘se Karen Allen
D‘se Michael Cockram
D‘se Ross Goodman
D‘se Anneliese Heinrich
D‘se Mike Petrlik
D‘se Emiko Wong
D‘se Timothy Arthur, agent de liaison avec le Conseil
D‘se Liane Nelson, agent de liaison avec le Conseil

Membres d’office
D‘se Marie-Odile Rozon (ACIA)
Mme Gilly Griffin (CCPA)
Mme Toolika Rastogi (FSCAA)
D‘se Ted Kilpatrick (OVMA)
D‘se Marilyn Keaney (ACMAL)
D‘se Bettina Bobsein (Section ACMV-SBCV)
Mme Kate Cooper, RVT (TTVAC)

Comité de la rédaction
D‘se Ron Lewis, président
D‘se Carlton Gyles, rédacteur en chef, La RVC
D‘se Bruce Grahm, rédacteur associé, La RVC
D‘se Wayne McDonell, rédacteur associé, La RVC
D‘se Eva Nagy, rédactrice, RCRV
D‘se Faizal A. Careem, rédacteur associé, RCRV
D‘se Karin Orsel, agente de liaison avec le Conseil
Editorial Committee
Dr. Ron Lewis, Chair
Dr. Carlton Gyles, Editor-in-Chief, CVJ
Dr. Bruce Graham, Associate Editor, CVJ
Dr. Wayne McDonell, Associate Editor, CVJ
Dr. Éva Nagy, Editor, CJVR
Dr. Faizal A. Careem, Associate Editor, CJVR
Dr. Karin Orsel, Council Liaison

National Examining Board
Dr. Jack Wilson, Chair
Dr. Juanita Glencross-Winslow (NB, NS, PEI & NL)
Dr. David Scammell (MB/SK)
Dr. Mihály Szöke (Québec)
VACANT (Ontario)
Dr. Annabelle Denson (AB)
Dr. Joanne Weetman (BC)
Ms. Susan Hodgson, Public representative
Dr. Louis Kwantane, Council Liaison
Mr. Jost am Rhyn, Registrar

National Issues Committee
Dr. Henry Ceelen, Chair
Dr. Serge Chalhoub
Dr. Nicole Jewett
Dr. Ian Sandler
Dr. Christiane Armstrong, Council Liaison
Dr. Trevor Lawson, Council Liaison
Ms. Lois Ridgway, Council Liaison
Ex-officio Members
Dr. Debbie Barr (CFIA)

Professional Development Committee
Dr. Brandon Laing, Chair
Dr. Sue McTaggart
Dr. Jim Berry
Dr. Kathleen MacMillan, Scientific Coordinator
Dr. Marie-Claude Blais, Chair 2020
VACANT, Chair 2021
Dr. Margaret Brown-Bury, Council Liaison

Ex-Officio Members
Ms. Carolyn Cartwright (RVTTC)
Ms. Shannon Brownrigg (RVTTC)
Dr. Fran Rotondo, Industry

Students of the CVMA (SCVMA)
Ms. Audrey Roy, President (FMV)
Ms. Meredith Garcia (OVC)
Ms. Emma Bush (AVC)
Ms. Vanessa Fussell (WCVM)
Ms. Rachel Loppe (UCVM)

Council has approved the following CVMA representatives with external agencies for the 2020 calendar year:
Aquatic Animal Health Committee of CFIA’s National Aquatic Animal Health Program: Dr. Larry Hammell & Dr. Grace Karreman
Atlantic Veterinary College Advisory Council: Dr. Erin MacDonald

Bureau national des examineurs
D’ Jack Wilson, président
D’ David Scammell (Manitoba, Saskatchewan)
D’ Mihály Szöke (Québec)
VACANT (Ontario)
D’ª Annabelle Denson (Alberta)
D’ª Joanne Weetman (Colombie-Britannique)
M’ªe Susan Hodgson, membre du public
D’ Louis Kwantane, agent de liaison avec le Conseil
M. Jost am Rhyn, registraire

Comité sur les enjeux nationaux
D’ Henry Ceelen, président
D’ Serge Chalhoub
D’ª Nicole Jewett
D’ Ian Sandler
D’ª Christiane Armstrong, agent de liaison avec le Conseil
D’ Trevor Lawson, agent de liaison avec le Conseil
M’ªe Lois Ridgway, agent de liaison avec le Conseil

Membre d’office
D’ª Debbie Barr (ACIA)

Comité de développement professionnel
D’ Brandon Laing, président
D’ª Sue McTaggart
D’ Jim Berry
D’ª Kathleen MacMillan, coordonnatrice du programme scientifique
D’ª Marie-Claude Blais, présidente du Congrès de 2020
VACANT, président(e) du Congrès de 2021
D’ª Margaret Brown-Bury, agent de liaison avec le Conseil

Membres d’office
M’ªe Carolyn Cartwright (TTVAC)
M’ªe Shannon Brownrigg (TTVAC)
D’ª Fran Rotondo (Industrie)

Comité des étudiants de l’ACMV (ÉACMV)
M’ªe Audrey Roy, présidente (FMV)
M’ªe Meredith Garcia (OVC)
M’ªe Emma Bush (AVC)
M’ªe Vanessa Fussell (WCVM)
M’ªe Rachel Loppe (UCVM)


Comité de la santé des animaux aquatiques du Programme national sur la santé des animaux aquatiques de l’ACIA :

D’ Larry Hammell et D’ª Grace Karreman

Atlantic Veterinary College Advisory Council :
D’ª Erin MacDonald

Aquariums et zoos accrédités du Canada : D’ª Patricia Alderson
Coalition canadienne pour la santé des animaux :
D’ª Richard Devos

Comité consultatif canadien sur la réglementation des produits de santé animale : D’ª Shane Renwick

Système canadien de surveillance de la santé animale (SCSSA) :
D’ª Shane Renwick
Canada’s Accredited Zoos and Aquariums: 
Dr. Patricia Alderson

Canadian Animal Health Coalition: Dr. Richard Devos

Canadian Animal Health Products Regulatory Advisory Committee: Dr. Shane Renwick

Canadian Animal Health Surveillance System: 
Dr. Shane Renwick

CAHSS Equestrian Canada National Equine Disease and Welfare Surveillance: Dr. Mary Bell

Canadian Cattle Identification Agency: Dr. Oliver Schunitch

Canadian Council on Animal Care: Dr. Andrew Winterborn

Canadian Veterinary Reserve Advisory Board: Dr. John Drake

Canadian Pork Council’s Quality Assurance Program:
Dr. George Charbonneau

Council on Education: Dr. David Scammell

Educational Commission for Foreign Veterinary Graduates: 
Dr. Bev Baxter

Equestrian Canada: Dr. Wayne Burwash

Federation of Veterinarians of Europe: Dr. Enid Stiles

National Board of Veterinary Medical Examiners:
Dr. Jack Wilson

National Companion Animal Coalition: Dr. Kelly Butler

National Farm Animal Care Council: Dr. Michelle Groleau

National Farmed Animal Health & Welfare Council:
Dr. Jim Fairles

PANVET: Dr. Theresa Bernardo

Pet Nutrition Alliance: Dr. Jim Berry

Registered Veterinary Technologists and Technicians of Canada: Dr. Louis Kwantes

University of Calgary Veterinary Medicine Stakeholder Advisory Council: Dr. Louis Kwantes

Western College of Veterinary Medicine Advisory Council:
Dr. Tracy Fisher

World Small Animal Veterinary Association:
Dr. Terri Chotowetz

World Veterinary Association: Dr. Troye McPherson

WVA Advisory Group on Pharmaceutical Stewardship:
Dr. John Prescott

SCSSA – Equestrian Canada National Equine Disease and Welfare Surveillance: Dr. Mary Bell

Agence canadienne d’identification du bétail : 
Dr. Oliver Schunitch

Conseil canadien de protection des animaux : 
Dr. Andrew Winterborn

Conseil consultatif de la Réserve vétérinaire canadienne :
Dr. John Drake

Programme Assurance qualité canadienne (AQC) du Conseil canadien du porc : Dr. George Charbonneau

Council on Education : Dr. David Scammell

Educational Commission for Foreign Veterinary Graduates:
Dr. Bev Baxter

Canada Équestre : Dr. Wayne Burwash

Federation of Veterinarians of Europe (FVE) : Dr. Enid Stiles

National Board of Veterinary Medical Examiners (NBVME) :
Dr. Jack Wilson

Coalition nationale sur les animaux de compagnie :
Dr. Bev Baxter

Conseil national pour les soins aux animaux d’élevage :
Dr. Michelle Groleau

Conseil national sur la santé et le bien-être des animaux d’élevage : Dr. Jim Fairles

PANVET : Dr. Theresa Bernardo

Pet Nutrition Alliance : Dr. Jim Berry

Technologues et techniciens vétérinaires agréés du Canada (TTVAC) : Dr. Louis Kwantes

University of Calgary Veterinary Medicine Stakeholder Advisory Council : Dr. Louis Kwantes

Western College of Veterinary Medicine Advisory Council :
Dr. Tracy Fisher

World Small Animal Veterinary Association (WSAVA) :
Dr. Terri Chotowetz

World Veterinary Association (WVA) : Dr. Troye McPherson

WVA Advisory Group on Pharmaceutical Stewardship :
Dr. John Prescott
The CVJ — 60 years: The Canadian Veterinary Journal is celebrating its 60th anniversary in 2020! The CVJ plays a very important role in the peer reviewing and publishing of articles essential to the science-based veterinary profession and the health and well-being of animals. The CVJ provides the profession, on a monthly basis, with scientific content and feature articles. The CVJ has an average circulation of 6500, and is also published online. In addition, since 2007, it is accessible through PubMed Central.

2020 CVMA Convention: This year’s CVMA Convention will take place from July 9 to 12 in Quebec City, Quebec. It will feature 19 tracks and 43 speakers, providing for great diversity. This year’s CVMA Summit will be on “Addressing Climate Change: A One Health Approach.” The CVMA National Issues Forum will focus on Veterinary Medicine and Natural Disasters.

2021 and 2022 CVMA Conventions: The CVMA will host its 2021 Convention from July 22–25 in Calgary, Alberta. The 2022 Convention will take place from July 22–24 in Halifax, Nova Scotia.

(by Jost am Rhyn, CEO, CVMA)

It’s Open Season on Ticks! Are You Ready?

The expansion of blacklegged ticks into Canada has been a real game-changer for veterinarians and pet parents. In just a few years, these parasites have gone from relative obscurity to being front page news. This rapid expansion creates a growing need for us to educate pet parents and update our parasite control protocols to address this emerging threat.

“Because blacklegged ticks can be active anytime temperatures are 4°C and above, we could say that they’re parasites for all seasons,” notes Dr. Melanie Hicks, president of the Canadian Veterinary Medical Association (CVMA). “Yet despite that, many pet parents still think of parasite control as something to consider only during warm-weather months.”

C’est la saison des tiques! Étes-vous prêts?

L’expansion de la distribution géographique des tiques à pattes noires au Canada a vraiment changé la donne pour les médecins vétérinaires et les propriétaires d’animaux de compagnie. En quelques années à peine, ces parasites sont passés d’une relative obscurité à un sujet d’actualité. Cette propagation rapide des tiques crée un besoin croissant pour nous d’éduquer les propriétaires d’animaux de compagnie et de mettre à jour nos protocoles de maîtrise des parasites pour faire face à cette menace émergente.

“Comme les tiques à pattes noires peuvent être actives à tout moment dès que la température est de 4 °C ou plus, on peut affirmer qu’elles sont préoccupantes tout au long de l’année », note la Dr. Melanie Hicks, présidente de l’Association canadienne des
“Trying to change people’s perceptions and habits can take time,” adds Dr. Hicks. “The fact that National Tick Awareness Month (NTAM) is in March, when temperatures are often at or above 4°C, is significant in that it provides veterinarians with an ideal opportunity to initiate the ‘tick talk’ and ensure pets are adequately protected for the entire tick risk period.”

As in previous years, the CVMA and its NTAM partner, Merck Animal Health, have produced communication material and support tools to help veterinary teams highlight the unique seasonality of ticks, to provide pet parents with updates regarding the expansion of ticks across Canada, and to increase awareness of the One Health approach to tick control and Lyme disease prevention.

Pet-owner engagement tools:
• An animated video presenting the 2020 NTAM campaign’s main theme: *Tick season can be every season.*
• A poster highlighting the same theme, for display in clinics.
• Ready-to-use social media posts, shareable videos, and website content for use by clinics.
• The TickTalkCanada.com website, updated with new content covering the themes featured in the 2020 NTAM campaign.

**NTAM launch webinar**

On March 2, 2020, Robbin Lindsay, MSc, PhD, research scientist at the Public Health Agency of Canada’s National Microbiology Laboratory, and Dr. Katie Clow, DVM, PhD, assistant professor in One Health in the Department of Population Medicine at the Ontario Veterinary College, will present a live webinar during which they will discuss the 3 key topics of NTAM 2020 — tick seasonality, tick expansion, and One Health.

The recording of this webinar will be available for on-demand streaming on the CVMA website.

**How to access the NATM resources**

For more information on National Tick Awareness Month, and to access all NTAM resources (including the recording of the NTAM launch webinar, video animation, waiting-room posters and shareable content), please visit the CVMA website (canadianveterinarians.net/practice-economics/practice-tools-national-tick-awareness-month).

mèdecins vétérinaires (ACMV). « Pourtant, malgré cela, de nombreux propriétaires d’animaux de compagnie considèrent toujours la lutte contre les parasites comme une chose à laquelle il faut penser seulement pendant les mois chauds. »

* Faire changer les perceptions et les habitudes des gens peut prendre du temps *, ajoute la D恶劣 Hicks. « Le fait que le Mois national de sensibilisation aux tiques (MNST) soit en mars, lorsque les températures sont souvent égales ou supérieures à 4 °C, est significatif, car il fournit aux médecins vétérinaires une occasion idéale d’aborder le sujet des tiques pour s’assurer que les animaux de compagnie sont adéquatement protégés pendant toute la période de risque d’infestation par les tiques. »

Comme les années précédentes, l’ACMV et son partenaire du MNST, Merck Santé animale, ont produit du matériel de communication et des outils pour aider les équipes vétérinaires à mettre en évidence la saisonnalité unique des tiques, à fournir aux propriétaires d’animaux de compagnie des mises à jour concernant l’expansion des tiques au Canada et à accroître la sensibilisation à l’approche « Une santé » pour la lutte contre les tiques et la préservation de la maladie de Lyme.

**Outils pour renseigner les propriétaires d’animaux :**
• Une vidéo animée qui présente le thème principal de la campagne du MNST de 2020 : *Les saisons passent, les tiques persistent.*
• Une affiche pour la clinique qui met en valeur le même thème.
• Des publications pour médias sociaux, des vidéos partageables et du contenu pour site Web que les cliniques peuvent utiliser.
• Le site TiqueTocCanada.com, mis à jour avec du nouveau contenu lié aux thèmes présentés dans la campagne du MNST de 2020.

**Webinaire de lancement du Mois national de sensibilisation aux tiques**


L’enregistrement de ce webinaire sera disponible pour visionnement sur demande sur le site Web de l’ACMV.

**Accès aux ressources du MNST**

Excitant! Inspirant! Motivant!
2020 CVMA Convention —
July 9 to 12
Le Congrès de l’ACMV est dans moins de 5 mois! Inscrivez-vous sans tarder si ce n’est pas déjà fait et faites des économies durant la période d’inscription hâtive en vigueur jusqu’au 30 avril.

Le jeudi 9 juillet, Mme Shannon Gervais et le Dr’ Craig Mosley présenteront 6 séances relatives au champ de pratique des techniciens en santé animale, sous le thème de la gestion « Une carrière réussie : une vie équilibrée », et la dernière séance réunira des conférenciers experts pour une table ronde. Les sujets abordés seront notamment l’état actuel de l’utilisation des techniciens au Canada en mettant l’accent sur la législation provinciale et le champ d’exercice; des modèles exemplaires d’utilisation des techniciens vétérinaires dans de multiples environnements comme les pratiques de soins primaires, des grands animaux et de spécialité; les facteurs ayant un impact sur la perte de techniciens de la profession et ce qui pourrait être fait pour réduire ces pertes; et les sources de revenus et comment les techniciens peuvent y contribuer.

Nous sommes ravis de vous présenter notre conférencier d’honneur, le Dr Pierre-Yves Daoust. Dr. Daoust travaille pour la Canadian Wildlife Health Cooperative au Atlantic Veterinary College de l’Île-du-Prince-Édouard. Dr. Daoust parlera de la faune et des multiples facettes de la médecine vétérinaire le vendredi 10 juillet. Selon ses dires, son expérience en tant que pathologiste de la faune n’est pas unique, mais a été très gratifiante au fil des ans. Il a été appelé à se prononcer sur les questions de bien-être animal liées à la chasse au phoque et au piégeage, a participé aux investigations visant à déterminer les causes de mortalité des baleines noires de l’Atlantique Nord et de nombreux autres animaux marins, et a travaillé en étroite collaboration avec les chasseurs inuits, peut-être l’expérience la plus enrichissante de toutes. Le respect des gens, des animaux et de l’environnement a imprégné tout ce travail.

Soyez au courant de tous les détails concernant le Congrès en téléchargeant l’application ou en consultant le site (https://pheedloop.com/cvma20/site/). Visitez le site Web de l’ACMV pour vous inscrire avant la date limite de la période d’inscription hâtive (30 avril 2020) pour profiter d’un tarif réduit. Au plaisir de vous voir à Québec!

(par Sarah Cunningham, responsable du Congrès de l’ACMV)
How the CVMA Supports Early Career DVMs
Soutien offert par l’ACMV aux médecins vétérinaires en début de carrière

Beginning a career is an exciting but sometimes challenging time in one’s professional and personal life. Here at the CVMA, we understand these challenges and have created a dedicated space on the CVMA’s website (www.canadianveterinarians.net) offering a variety of programs and resources to help support early career DVMs in achieving a successful career and a work/life balance.

Low staff morale, burnout, financial challenges, workplace drama? A host of related challenges can easily make veterinary careers less fulfilling. The Emerging Leaders Program can help bring joy back into the workplace by offering experienced professionals, and recent graduates, an opportunity to explore their approach to personal and professional accomplishments, and their working relationship with colleagues. All participants, regardless of their area of practice or years of experience, will come away enriched from this highly interactive workshop. The workshop will take place during the Annual Convention July 9 to 12 in beautiful Québec City, Québec. If you are interested, please visit the Convention section on the CVMA website.

Members can also take advantage of the Early-Career DVM Resource Hub, a space that provides sections focussing on financial planning and budgeting, communication, and career development. Within each section you’ll have access to modules, video lectures, personalized self-help programs, guides, tips, calculators, and more.

Another resource the CVMA offers is the Mentoring Program. Mentoring is the pairing of 2 people — a mentor and a mentee — to facilitate the sharing of professional skills and experiences, as well as enhancing career development. It provides a structured and trusting relationship by bringing less experienced veterinarians together with more experienced members of the profession, normally working in a similar field, who can offer
Dr. Dennis Will, who is chair of the Saskatchewan Veterinary Medical Association Animal Welfare Committee and a veterinary consultant, has done work in both Vietnam and Indonesia regarding humane destruction, animal welfare, biosecurity, and African Swine Fever (ASF). He says there is a significant lack of knowledge from the highest levels of government down to front-line staff dealing with disease control.

After his work in Vietnam last summer, he went to Denpasar in Bali, Indonesia, in November to help with the seminar of the regional Asian and Pacific centers on animal welfare. The seminar included a discussion about ASF, and its goal was to provide adapted information to the local needs and successes. It also evaluated the difficulties and highlighted the successes.

What these countries and veterinary leaders need most, are national and local practical information that correspond to their situation; the urgent needs of animal welfare and of disease control in urban areas, often are not adapted to the North American and European models. So we need to adapt our knowledge.

Did you know that members who maintain uninterrupted membership after graduation throughout a consecutive 3-year period are eligible for a tiered annual membership dues reduction?

<table>
<thead>
<tr>
<th>Year of graduation:</th>
<th>Complimentary half-year membership (July–December)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 after graduation:</td>
<td>75% off the regular dues plus a complimentary CVMA Convention CE voucher</td>
</tr>
<tr>
<td>Year 2 after graduation:</td>
<td>50% reduction of the regular dues</td>
</tr>
<tr>
<td>Year 3 after graduation:</td>
<td>25% reduction of the regular dues</td>
</tr>
</tbody>
</table>

Enfin, la rubrique de La Revue vétérinaire canadienne (La RVC) intitulée Ce qui ne s’enseigne pas présente des articles décrivant les expériences de carrière et les leçons de vie de médecins vétérinaires qui sont en début de carrière, en pratique privée ou retraités ainsi que de médecins vétérinaires qui ont choisi une autre voie que la pratique. Ces articles regorgent d’idées et de conseils pouvant être utiles pour les étudiants vétérinaires et les nouveaux diplômés.

Si l’un de ces programmes vous intéresse ou si vous souhaitez obtenir de plus amples renseignements, communiquez avec l’ACMV (admin@cvma-acmv.org).

Le D’ Dennis Will, président du comité du bien-être animal de la Saskatchewan Veterinary Medical Association et consultant vétérinaire, a effectué des travaux au Vietnam et en Indonésie sur la destruction sans cruauté, le bien-être des animaux, la biosécureté et la peste porcine africaine (PPA). Il a constaté un manque important de connaissances des plus hauts paliers du gouvernement jusqu’au personnel de première ligne chargé de la lutte contre les maladies.

Après son travail au Vietnam l’été dernier, il s’est rendu à Denpasar à Bali, en Indonésie, en novembre, pour assister au séminaire de formation des points focaux nationaux de la région Asie et Pacifique de l’Organisation mondiale de la santé animale (OIE) sur le bien-être animal. Le séminaire comportait une discussion importante sur la PPA, et son objectif était de fournir des connaissances adaptées aux conditions et aux besoins locaux. Il donnait aussi l’occasion d’évaluer les difficultés et de souligner les réussites.

Ce dont ces pays et les médecins vétérinaires en chef ont le plus besoin, c’est de l’information pratique nationale et de première ligne qui correspond à leur situation; les urgences de santé animale et de maîtrise des maladies se produisent fréquemment dans des environnements urbains denses, ou de type urbain. Souvent, les modèles conçus pour l’Amérique du Nord et l’Europe occidentale ne conviennent pas.
As a follow-up to his work in Vietnam last summer he travelled to Denpasar in Bali, Indonesia in November to attend the World Organisation of Animal Health (OIE) Asia and Pacific Region National Focal Points training seminar on Animal Welfare. It included significant discussion on ASF, and his objective was to provide knowledge tailored to meet their local needs and conditions. It was also an opportunity to assess challenges and recognize successes.

What these countries and the Chief Veterinary Officers (CVOs) need most is practical and hands-on national and frontline information that fits their situation; animal and disease control emergencies frequently occur in dense urban, or urban-like environments. The North American and Western European models frequently do not fit well.

There were 28 CVOs present at the 4-day seminar as Focal Point representatives for their respective countries. There were representatives from the OIE, Australia, New Zealand, as well as several Non-governmental Organizations (NGOs), including the Commonwealth Veterinary Association that made presentations and helped lead the discussion.

Dr. Will was asked to make a presentation on humane destruction for disease control purposes as it relates to ASF. During the discussion periods that followed the presentations there was a high degree of interest and several important and practical questions from each of the Focal Point representatives. A list of challenges these countries face was identified.

It was obvious that the lack of knowledge, skills and organizational structure in Vietnam (and the region) to address humane destruction is mirrored by a similar deficit in knowledge and skills pertaining to disease control and biosecurity. To effect change and bring about improvement there must be simultaneous improvements in each of these knowledge and skill set gaps.

Dr. Will’s presentation in Bali covered all facets of a herd depopulation for disease control, as well as prerequisites in governance, organizational structure, and communication strategies.

Il y avait 28 médecins vétérinaires en chef présents au séminaire de quatre jours en tant que représentants des points focaux pour leurs pays respectifs. Des représentants de l’OIE, de l’Australie, de la Nouvelle-Zélande, ainsi que de plusieurs organisations non gouvernementales (ONG), dont la Commonwealth Veterinary Association, ont fait des présentations et aidé à orienter la discussion.

Le Dr Will a été invité à faire un exposé sur la destruction sans cruauté à des fins de maîtrise de la maladie en ce qui concerne la PPA. Au cours des périodes d’échange qui suivaient les présentations, il y a eu un degré élevé d’intérêt et plusieurs questions pratiques importantes de chacun des représentants des points focaux. Une liste des défis auxquels ces pays sont confrontés a été dressée.

Il était évident que le manque de connaissances, de compétences et de structure organisationnelle au Vietnam (et dans la région) pour gérer la destruction sans cruauté allait de pair avec un déficit similaire de connaissances et de compétences en matière de lutte contre les maladies et de biosécurité. Pour apporter des changements et faire des progrès, il doit y avoir des améliorations simultanées dans toutes ces sphères de connaissances et de compétences insuffisantes.

La présentation du Dr Will à Bali a couvert toutes les facettes de la dépopulation d’un troupeau pour maîtriser une maladie, ainsi que les conditions préalables en matière de gouvernance, de structure organisationnelle et de stratégies de communication. Elle portait également sur l’évaluation des installations et des locaux où l’éclosion s’est déclenchée, ainsi que l’élaboration d’un plan pratique. Le bien-être animal, la manipulation et la contention des animaux, la destruction sans cruauté, le confinement biologique, la maîtrise des maladies et l’élimination ont également été abordés.

Une formation sur le bien-être animal concernant l’abattage et le transport par terre et par mer a été offerte, et la partie sur le transport par mer a été particulièrement intéressante et informative. Cette région compte de nombreux petits pays, dont certains sont...
It also included the assessment of the facility and premises where the disease outbreak occurred, as well as the development of a practical plan. Animal welfare, animal handling and restraint, humane destruction, biocontainment and disease control, as well as disposal were also discussed.

Animal welfare training concerning slaughter and transport by land and at sea was provided, and the transportation by sea component was particularly interesting and informative. This region has many small countries, some of which are archipelagoes. Physical and financial resources are always challenging.

Although there are enormous knowledge and resource gaps to be filled, there have been improvements in awareness in many of these countries. The animal welfare concerns, their efforts to bring about change, and their successes were outlined by several country representatives. As individuals they deserve praise for their ongoing efforts, in sometimes challenging circumstances.

The representative for the Commonwealth Veterinary Association was the final speaker. His summation helped provide meaning and clarity to what had been discussed. He reviewed the role each of the CVOs should play in helping raise awareness, provide leadership, and bring about effective change in their respective countries. He was empathetic, offered encouragement, and was able to provide a global view.

Des archipels. L’accès à des ressources physiques et financières est toujours difficile.

Bien qu’il y ait d’énormes lacunes en matière de connaissances et de ressources à combler, il y a eu une amélioration de la sensibilisation dans bon nombre de ces pays. Les préoccupations concernant le bien-être animal, les initiatives pour apporter des changements et les réussites ont été soulignées par plusieurs représentants de divers pays. En tant qu’individus, ils méritent des éloges pour leurs efforts continus, dans des circonstances parfois difficiles.

Le représentant de la Commonwealth Veterinary Association était le dernier orateur. Son résumé a aidé à préciser et à clarifier ce qui avait été dit. Il a passé en revue le rôle que les médecins vétérinaires en chef devraient jouer pour aider à accroître la sensibilisation, à offrir un leadership et à apporter des changements efficaces dans leurs pays respectifs. Il a été en mesure de fournir une vision globale tout en étant empathique et encourageant.

### Member authors benefit from discounted fees for CVJ and CVJR

Did you know? CVMA members who publish manuscripts in *The Canadian Veterinary Journal* or in the *Canadian Journal of Veterinary Research* are entitled to discounted publication fees and page charges.

Please check the Instructions for Authors on each Journal web page to confirm the current fees and to review submission guidelines ([www.canadianveterinarians.net](http://www.canadianveterinarians.net)). For additional information, contact the CVMA Journals Department.

Membership in CVMA does have its privileges!
Case Report Rapport de cas

Congenital phimosis causing preputial swelling in a newborn foal
Igor F. Canisso, Robyn E. Ellerbrock, Pamela A. Wilkins

Abstract — An 18-hour-old colt was presented for abdominal discomfort, preputial swelling, and frequent posturing to urinate. Examination of the scrotum confirmed 2 testes and no scrotal or inguinal hernia. Transabdominal ultrasound identified a distended bladder and no free fluid in the peritoneal cavity. Inspection of the preputial cavity revealed that the internal lamina of the prepuce was mostly attached to the glans penis. The preputial cavity was lubricated and manual traction was applied to detach the internal lamina of the prepuce from the glans penis. The colt urinated spontaneously 1 hour after the procedure, and the preputial swelling slowly resolved over 7 days.

Key clinical message:
Congenital phimosis in a newborn foal was resolved by manual separation of the penile epithelium and preputial lamina.

Résumé — Phimosis, une cause d’œdème du prépuce chez un poulain nouveau-né. Un poulain de 18 heures de vie a été examiné en raison d’un inconfort abdominal, d’un œdème du prépuce et d’une mise en position fréquente pour uriner. L’examen du scrotum a confirmé la présence de deux testicules et l’absence d’hernie scrotale ou inguinale. Une échographie abdominale a permis de confirmer une vessie dilatée et l’absence de liquide dans la cavité péritonéale. L’examen de la cavité préputiale a révélé que la couche interne du prépuce était complètement attachée au gland du pénis. La cavité préputiale a été lubrifiée et une traction manuelle a été appliquée à la couche interne du prépuce pour la détacher du gland du pénis. Le poulain a recommencé à uriner spontanément une heure après la procédure et l’œdème du prépuce s’est résorbé sur une période de sept jours.

Message clinique clé :
Le phimosis congénital chez un nouveau-né a été résolu par séparation manuelle de l’épithélium pénien et de la lame préputiale.


Case description

An 11-year-old, 678 kg, multiparous pregnant Tennessee Walker mare delivered a colt at 342 d of gestation. Parturition was uneventful, and the foal was delivered within 20 min of chorioallantois rupture. Immediately after delivery, the foal was dried, and the umbilicus was dipped in 2% chlorhexidine solution (q6h for 2 d and then q12h for 3 d). The foal also received an enema (133 mL; Fleet Laboratories, Brooklyn, New York, USA) within the first hour postpartum for meconium retention prophylaxis. The 54 kg colt displayed normal mentation and righting reflex within 5 to 20 min, stood within 1 h, and started to nurse by 2 h after delivery. The mare passed the fetal membranes within 3 h postpartum, and examinations of the postpartum mare and fetal membranes were unremarkable. The urachus was distended at the level of the amniotic segment of the umbilical cord (Figure 1A).

Throughout the rest of the night and early morning, the foal displayed normal demeanor (nursing, mentation, righting reflexes) and passed meconium. By 10 h postpartum, the foal had a normal physical examination, complete blood (cell) count (CBC) within normal limits, and adequate passive transfer of immunity (> 8 g/L; Snap Foal IgG test IDEXX laboratories, Westbrook, Maine, USA). By 18 h postpartum, the demeanor of the colt was consistent with abdominal discomfort (leg shifting and tail switching) and he was observed frequently posturing to urinate without urination. The results of a complete physical examination were unremarkable, except for a swollen prepuce (Figure 1B). The foal was restrained in lateral recumbency and detailed examination of the external genitalia confirmed that...
edema was restricted to the prepuce. The scrotum was not swollen, with 2 apparently normal testicles, and no palpable scrotal or inguinal hernia. Transabdominal ultrasound (5 MHz linear transducer; Ibex Evo, E.I. Medical Imaging, Loveland, Colorado, USA) revealed normal umbilical structures, a distended bladder, and no free fluid in the peritoneal cavity. Inspection of the preputial cavity revealed that the internal lamina of the prepuce was folded and attached to the penile shaft and to the glans penis, causing the prepuce to occlude the urethra, thus inhibiting urine flow.

Here, we describe an atypical case in which the internal lamina of the prepuce was attached to the penis as expected, but the attachment to at least 2/3 of the glans penis prevented the foal from spontaneously urinating by physically covering the urethral fossa and urethral process. Constriction of the preputial orifice or physical abnormalities of the penis were not detected during a physical examination, suggesting a failure of laminar detachment as the cause of phimosis. Despite being initially classified as physiologic phimosis, the inability to urinate led to urine accumulation in the preputial cavity with secondary mucosal inflammation, intense preputial swelling and total occlusion of the preputial ring.

The foal was placed in lateral recumbency, the preputial cavity was lubricated with sterile lubricant, and manual pressure was gently applied caudally to cranially in the prepuce to facilitate the inspection of the preputial cavity (Figure 2A). The internal lamina of the prepuce was gently detached from the glans using gauze to expose the penis (Figures 2A–B). The attachment of the internal lamina of the prepuce covered most of the glans's surface illustrated by the red area (Figure 2C). Immediately after the manual detachment procedure, the penis retracted into the preputial cavity (Figure 2D). The colt received 2 doses of flunixin meglumine [0.75 mg/kg body weight (BW), IV, q24h, for 2 d; Flunixiject; Butler Schein, Dublin, Ohio, USA]. Intermittent erection, penile prolapse, and minor balanitis were observed for 2 d after the procedure. The colt was able to urinate spontaneously within 1 h after the procedure and continued to urinate normally until discharge. The prepuce and umbilicus were swollen for 3 d, and then gradually declined to normal by 7 d. The penis and prepuce were cleaned daily for 3 d with saline solution and then lubricated with sterile lubricant. Mare and foal were discharged from the hospital and remained healthy after discharge. The foal was kept in a stall for 7 d and then turned out on pasture with the dam. The colt had no further difficulties urinating, and all swelling had resolved by 7 d postpartum.

Discussion

The present case describes the congenital attachment of the internal lamina of the prepuce to not only the penile shaft, but also the majority of the glans penis of a newborn colt, which prevented the foal from urinating, and caused preputial edema. The manual detachment procedure provided immediate release of the glans penis and allowed the colt to urinate and to continue normal micturition. While it is uncertain whether the detachment would have occurred spontaneously if we had not intervened, we believe that without intervention the foal may have developed complications such as uroperitoneum, patent urachus, or cellulitis associated with the significant subcutaneous edema (1).

The equine prepuce, or sheath, is composed of external (skin) and internal (mucosa) laminae covering the shaft and glans of the non-erect penis (2). The external lamina is continuous with the skin of the abdominal wall, while the internal lamina covers the penis (3). Most mammals (e.g., pigs, ruminants) are born with the penis completely attached to the internal lamina of the prepuce (frenulum). In these species, detachment of the penis from the internal lamina occurs around the onset of puberty, in association with increasing concentrations of androgen, and elongation of the sigmoid flexure (4). Foals, on the other hand, are either born with the penis completely detached from the prepuce, or the penis detaches from the prepuce's internal lamina shortly after birth.

Failure to observe the penis protruding in a newborn foal should not be considered pathologic phimosis before a detailed
physical examination. Typically, the penis completely detaches from the prepuce’s internal lamina shortly after foaling, or within 30 d of birth (5). Presence of urine scalding on the ventral abdomen or umbilicus can be indicative of improper urination and phimosis. Urine leakage with phimosis may cause regional scalding, dermatitis, and omphalitis (1). During an examination of a foal with a swollen prepuce, it is important to differentiate phimosis from other complications commonly seen in newborns, such as inguinal/scrotum/umbilical hernias, rupture/tear of the urachus, or an infected umbilicus (1). In the present case, the internal lamina of the prepuce covered the glans penis, preventing the colt from urinating, and causing urine retention in the prepuce and surrounding subcutaneous tissues.

The inability to protrude the penis from the preputial sheath, also known as phimosis, can lead to serious problems in the newborn or adult horse (6). Pathological phimosis is the result of injury to the prepuce in adult horses and is uncommon in colts (6). In newborns, physiological phimosis usually results from a small preputial orifice or fused internal and external laminae that preclude penile extrusion. Physiologic phimosis is also common in the human male at birth, but as the penis grows during the first 3 y of life, epithelial debris accumulates under

---

**Figure 2.** Images of a newborn Tennessee Walker colt with congenital phimosis. Image A shows the penis of the colt during the initial physical examination, and the white arrow points to complete adherence of the penis to the internal lamina of the prepuce. B shows the manual breakdown of the phimosis; C and D show the penis and prepuce after the completed procedure.
the prepuce, gradually separating the foreskin from the glans (7). Manual detachment of the penis from the prepuce has been used in human medicine to treat phimosis under general anesthesia with a variable success of 50% to 85% (7). Common sequelae after manual retraction of the prepuce include stenosis, the formation of strong adhesions, or swelling (7). Since the attachment of the glans penis to the internal lamina of the prepuce in horses appears less pronounced than in humans, we performed the procedure without sedation or general anesthesia as used in humans (7). Edema, likely secondary to sterile cellulitis induced by urine accumulation, remained pronounced for the first 72 hours after the procedure.

Interestingly, the present case had remarkable urachal distension seen as 3 large pockets of fluid within the umbilical cord. This condition has been seen in cases with excessive umbilical cord twists, or entrapment of the cord, but has also been seen in normal foalings (8). Fetal urine is released into the amniotic fluid via the penis or vagina, and into the allantoic cavity via the urachus. While there is no evidence to prove that the distended urachus and the attachment of the internal lamina of the prepuce to the penis were associated events, we hypothesized that the remarkable distension of the urachus in the present case could have been the result of excessive pressure and fluid buildup, given that the fetus could not urinate normally through the urethra.

In conclusion, the separation of the glans penis and preputial lamina by continuous traction was shown herein to be an efficient non-surgical treatment for congenital phimosis in a newborn foal. Monitoring of urination and a preputial physical examination of all newborn foals followed by prompt treatment of glans adherence and associated micturition dysfunction are encouraged to avoid secondary clinical problems with the prepuce and umbilicus of the newborn.

Acknowledgment

The authors are grateful to Dr. Sophie Rajotte for translating the abstract and title to French.

References


Wild Salmon Oil Blend-VM™

Per 5 mL dose
Salmon (60%) + Anchovy, Mackerel, Sardine (40%)
- Omega 3 ................................................... 1375 mg
- EPA (Eicosapentaenoic acid) .......... 825 mg
- DHA (Docosahexaenoic acid) .......... 550 mg
Health Canada # NN.D7H7

Omega 3/6/9-VM™

Per 5 mL dose
Omega 3 .......................................................... 1500 mg
- ALA (alpha-Linolenic acid) 1000 mg
- EPA (Eicosapentaenoic acid) 300 mg
- DHA (Docosahexaenoic acid) 200 mg
Omega 6 ........................................................... 1250 mg
Omega 9 ........................................................... 850 mg
Health Canada # NN.Z8C6

✓ No toxins, pesticides, or heavy metals
✓ NON-GMO, GMP, Human Grade Oils
✓ Oils are molecularly distilled ensuring purity

1-888-299-0318 • AlphaVetScience.com
Case Report  
Rapport de cas

Scapula fracture secondary to metastatic pulmonary carcinoma in a horse: Clinical, sonographic, radiographic, computed tomographic, and pathologic findings

Jannah Pye, Isabelle Kilcoyne, Melissa Roy, Betsy Vaughan, Carol Ormond, Mathieu Spriet

Abstract — A 20-year-old Quarter horse gelding was referred for evaluation of an acute onset non-weight-bearing right forelimb lameness. Marked soft tissue swelling was apparent over the right scapula and shoulder region; no crepitus was palpable. A complete transverse fracture of the scapular neck was suspected based on ultrasonography and radiographs were obtained to confirm the presumptive diagnosis. A complete, oblique fracture of the right scapular neck with mild cranial and proximal displacement of the distal fragment was detected. Computed tomography of the upper right forelimb was performed post-mortem; lytic bony destruction of the scapular neck with a secondary pathologic fracture was observed. The lesion was considered most likely neoplastic. At necropsy a complete, comminuted fracture of the right scapula was confirmed, secondary to neoplastic invasion of the bone. A solitary, dorsally located, neoplastic mass was also observed within the parenchyma of the right caudal lung. Histopathologically, the lung and scapula lesions were similar, characteristic of a well-differentiated pulmonary carcinoma.


Can Vet J 2020;61:251–256

Tumors in the thoracic cavity of horses are uncommon and may occur as primary thoracic neoplasms or tumors that metastasize to the chest from a primary site elsewhere in the body (1–4). The incidence of primary pulmonary carcinoma is particularly low, diagnosed in only 2 of 38 horses (5.3%) with confirmed thoracic neoplasms in 1 case series (3). An antemortem diagnosis of neoplasia was not achieved in either of these 2 cases (3). The clinical manifestations of thoracic neoplasia are variable depending on the location of the tumor and the severity of the pathology (3,4). Lameness may occur secondary to bone infiltration and lysis from metastatic pulmonary neoplasia; however, fracture of the appendicular skeleton secondary to metastatic pulmonary neoplastic infiltration has not been reported (4). This case report describes a pathological fracture of the scapula in...
an equine patient secondary to metastatic pulmonary carcinoma. The clinical, radiological, ultrasonographic, computed tomographic, and pathological features of this neoplasm are presented.

**Case description**

A 20-year-old Quarter horse gelding was referred to the William R. Pritchard Veterinary Medical Teaching Hospital (VMTH) at the University of California, Davis for evaluation of an acute, severe right forelimb lameness. The gelding had stumbled on a trail ride approximately 4 h before presentation and was unable to bear weight on the right forelimb after the incident. The referring veterinarian administered flunixin meglumine, 500 mg, IV, once and referred the horse to the VMTH.

On admission, the gelding was moderately tachycardic (60 beats/min) and unwilling to walk. The horse was able to bear weight evenly on all 4 limbs when standing still, but when encouraged to walk became non-weight-bearing on the right forelimb and was unable to protract the limb. Marked soft tissue swelling was apparent over the scapula and shoulder joint, though no crepitus was palpable.

No hematological abnormalities were apparent on routine complete blood (cell) count (CBC); however, serum biochemistry showed moderate hypophosphatemia [1.2 mmol/L; reference range (RR): 0.68 to 1.52 mmol/L]. Ultrasonographic examination of the right scapula and scapulohumeral joint was performed. There were multiple adjacent step defects at the distal aspect of the supraspinous fossa just proximal to the neck of the scapula with cranial displacement of the fragments (Figures 1A, B). The infraspinous fossa had an irregular bony surface at the same level. The supraspinatus and infraspinatus muscles were unremarkable with the exception of intramuscular edema. The shoulder joint was mildly irregular along its articular margin. Moderate anechoic effusion was apparent within the bicipital bursa. A comminuted fracture of the distal scapula with associated intramuscular edema of the supraspinatus and infraspinatus muscles was diagnosed.

Radiographs were taken to further characterize the fracture and to investigate the possibility of concurrent humeral fracture. Standing mediolateral (Figure 2) and oblique radiographs of the right scapulohumeral joint were obtained. There was a complete, oblique fracture of the right scapula neck with mild cranial and proximal displacement of the distal fragment.

Differential diagnoses included a fracture secondary to trauma or a pathologic fracture secondary to malignant neoplasia or silicate associated osteoporosis. A poor prognosis for survival was given due to the severity of the fracture, and the owners elected euthanasia. Permission was granted by the owners for necropsy and post-mortem diagnostic tests.

Prior to necropsy, the right forelimb was separated between the scapula and the lateral thoracic wall. Computed tomography of the right scapulohumeral joint was performed. Transverse images (0.6 mm thick) of the scapula and proximal humerus in a bone algorithm were acquired. There was severe osteolysis through the proximal aspect of the neck of the scapula with complete destruction of the medial cortex and nearly complete lysis of the lateral cortex. The margins of the lytic area were poorly defined with a long zone of transition. Moderate osteoproliferation with a relatively smooth margin was identified at
the medial aspect of the scapula, surrounding the area of lysis. A small amount of osteoproliferation was also present at the caudal lateral aspect of the lytic area. There was complete disruption of the cranial and caudal borders of the neck of the scapula due to a pathologic fracture (Figures 3A, B). A large cortical fragment from the caudal border, with marked resorption, was displaced caudally and distally. Small mineral fragments were present in the soft tissues at the distal aspect of this fragment. The distal part of the scapula was displaced mildly cranially and proximally. The glenoid cavity of the scapula and the proximal humerus were intact. Based on the primary destructive appearance of the scapula lesion, a neoplastic process was suspected. Osteomyelitis or an unusual focal osteolytic lesion secondary to bone fragility syndrome (Silicate Associated Osteoporosis) was considered less likely.

At necropsy, the body was found to be in good post-mortem condition and contained adequate subcutaneous and visceral adipose stores. The right scapula was sectioned transversely using a standard pathology band saw and photographed. There was a complete, comminuted fracture with proximal displacement of the neck of the right scapula. Five variably sized comminuted bone fragments were present, the largest of which originated from the caudal aspect of the scapular wing and measured approximately 5 × 3 × 1.5 cm. Fracture fragments were hard and topographically irregular, with pitted margins. Bony proliferation was present on both cortical and medullary surfaces, and there was soft, tan, gritty tissue to soft rubbery tissue within the medullary cavity in the region of the fracture and extending into the pitted fracture margins. The surrounding soft tissues were edematous and hemorrhagic, with bone dust and countless tiny bone fragments throughout. The articular surfaces of the glenohumeral joint were mildly and irregularly eroded, with joint fluid within normal gross limits. These changes were consistent with age-related degenerative disease, unrelated to the fracture affecting the neck of the scapula.

Within the parenchyma and bulging the overlying pleura of the right caudal lung was a focal, well-demarcated, rubbery to firm, white to tan, irregularly margined 9 × 8 × 5.5 cm

Figure 3. A – Reconstructed computed tomography image (lateromedial orientation) showing complete disruption of the cranial and caudal borders of the neck of the scapula due to a pathologic fracture. B – Reconstructed computed tomography image (craniocaudal orientation).
mass. There were regions of the mass which were softer, or had a coarse, grainy texture.

Transverse tissue specimens of the right scapula and lung mass were fixed in 10% neutral buffered formalin. Subsequently, scapula tissue was demineralized in 15% formic acid. Both tissues were paraffin embedded, sectioned at 6 µm and stained with hematoxylin and eosin (H&E). Histologically, both masses were characterized as carcinomatous with tissue patterns consistent with pulmonary epithelium. The following tissues were also examined microscopically; thoracic inlet lymph node, pre-scapular lymph node, tonsil, kidney, spleen, liver, and heart.

The examined pulmonary tissue was composed of an infiltrative, moderately cellular, unencapsulated, well-demarcated mass composed of neoplastic epithelial cells within dense fibrovascular stroma (Figure 4A). Neoplastic cells were variably arranged in papillary and acinar patterns, and in some regions formed individual clusters and islands (Figure 4B). Individual cells were cuboidal to polygonal, had variably distinct cell margins, and contained abundant eosinophilic cytoplasm. Nuclei were round to irregularly shaped, with finely stippled chromatin and 1 to 2 nucleoli. Anisocytosis and anisokaryosis were marked, and there were 17 mitotic figures per 10 high power fields (hpf). Individual cell necrosis was common, and approximately 50% of the examined mass was necrotic. The neoplastic cells were surrounded by abundant, pale basophilic fibrovascular stroma (desmoplasia) with multifocal chondroid metaplasia, and scattered lymphocytes, plasma cells, and clumps of golden-brown pigment (hemosiderin).

Three sections of decalcified scapula were examined, in the vicinity of the pathologic fracture. Marrow spaces were filled...
with large amounts of dense variably mature fibrovascular stroma punctuated by individual cells, islands, and short, irregular papillary fronds of pleomorphic epithelial cells (Figure 5A). Individual cells had variably distinct cell margins, and abundant eosinophilic cytoplasm. Nuclei were round, with finely stippled chromatin and 1 to 2 variably distinct nucleoli. Approximately 90% of the neoplastic cells and surrounding stroma were necrotic. Trabecular medullary bone was often fragmented, with scalloped edges lined by moderate numbers of osteoclasts (Figure 5B).

Discussion

The pathological diagnosis in the present case was primary pulmonary carcinoma with metastasis to the right scapula resulting in pathological fracture. Pulmonary and bronchial carcinoma and adenocarcinomas are uncommon in horses but have been described in sporadic case reports (1–3,5,6). The finding of a primary pulmonary carcinoma was unexpected due to the lack of respiratory clinical signs or any prior history indicating respiratory compromise. In previous reports of pulmonary neoplasia in horses, the presence of specific respiratory signs was dependent on the location of the tumor (3). Significant coughing was noted in 1 horse with a mediastinal mass compressing the major bronchi and trachea, whereas nodular infiltration of the parenchyma was not associated with coughing (3). Dyspnea was recorded in cases associated with pleural effusion (3). The lack of signs referable to the respiratory system in this case may be related to the location and foci of the tumor within the pulmonary parenchyma, and the lack of associated pleural effusion. Furthermore, the gelding was used for light riding only, and potentially would have displayed exercise intolerance if required to perform more strenuous work.

Metastatic tumors affecting the musculoskeletal system have been reported in horses. Tumor types known to metastasize to the skeleton include lymphosarcoma/lymphoma and hemangiosarcoma, melanoma, fibroma, squamous cell carcinoma, and adenocarcinomas (7,8). There is 1 prior report of a primary pulmonary carcinoma metastasizing to the right atrium in a Quarter horse stallion, but no record of this particular type of neoplasm metastasizing to the skeletal system in a horse (1). As in the present case, clinical presentation and laboratory abnormalities in that case report were not indicative of the primary disease but were secondary to disease caused by metastatic tumors (i.e., cardiac failure). In our case, no respiratory signs had been noted by the owners, and lameness was not observed in the affected forelimb until the occurrence of pathological fracture. However, undoubtedly the metastatic lesion had been present in the right scapula for a significant time prior to fracture.

In humans, lung cancer is one of the most diagnosed malignancies, and the majority are carcinomas (9). Among domestic animals, primary pulmonary neoplasms are encountered most frequently in older dogs and cats and rarely in other species (10). Pulmonary carcinomas in domestic animals are described broadly as either adenocarcinoma or bronchioalveolar carcinoma (11). There is significant overlap in the histologic pattern of tumors from various sites of origin within the lung, and it is often difficult to determine precise histogenesis (12). Typically, tumors derived from the large airway epithelium are more often located near the hilus of the lung, whereas tumors of parenchymal origin tend to be peripheral, as in the present case. Tumors of large airway origin predominate in humans, associated with inhalation of carcinogens, whereas tumors of the bronchioalveolar region are more common in domestic animals (12).

The lung is also a frequent site for metastatic neoplasms and differentiating primary lung cancer from pulmonary metastasis resulting from malignant neoplasms elsewhere in the body can be challenging. Features supporting the diagnosis of a primary pulmonary neoplasm in this case include the presence of a single large lung mass composed of cells of epithelial origin. Most primary malignant neoplasms of the lungs appear as solitary masses of variable size that can metastasize to other areas of the lungs and to distant organs (10,12). There are no epithelial cells native to the bone, and no other neoplastic masses were found on comprehensive post-mortem examination; therefore, the pulmonary mass was considered to be primary in this case. Carcinomas in other species that are more typically affected by this particular tumor subtype commonly metastasize to the bone (e.g., transitional cell carcinoma and pulmonary carcinoma in dogs) (10).

Histologic patterns typical of progressive differentiation from a bronchioalveolar pattern (papillary and acinar patterns) were noted in this case, consistent with a primary lung tumor (12). Also, the spectrum of progression of neoplastic transformation noted within the lung mass is suggestive of a primary tumor, as metastases tend to be more uniformly differentiated (12). Arguably, immunohistochemical staining could have been performed to support the histopathological diagnosis. Pancytokeratin immunohistochemical staining can distinguish epithelial from mesenchymal differentiation and may have been used to demonstrate the epithelial origin of the neoplastic scapula cells (13). Detection of thyroid transcription factor-1 by immunohistochemistry could have been used as an additional confirmatory test, as it is specific for tumors of bronchioalveolar origin (11,12).

This case highlights the fact that equine pulmonary carcinoma may metastasize to the appendicular skeleton, eventually resulting in catastrophic fracture. Horses affected by metastatic pulmonary carcinoma may show few or no preceding clinical signs of the primary disease or the metastatic process. Full necropsy is recommended whenever possible to identify metastatic disease which may not be clinically apparent.

References


Domidine®
Injectable 10 mg/mL detomidine hydrochloride solution available in convenient 10 and 20 mL vials. For use as a sedative and analgesic to facilitate minor surgical and diagnostic procedures in horses.
From the company that brings you Osphos® and HY-50®
Dechra Veterinary Products Inc. 1 Holiday Avenue, East Tower, Suite 345, Pointe-Claire, Quebec, H9R 5N3, Canada
Tel.: 1-855-332-9334 | Technical Services: technical.ca@dechra.com | www.dechra.ca
Canine retrobulbar lipoma excision through a ventral transpalpebral anterior orbitotomy

Lauren Charnock, Brianna Doran, Ellen Milley, Timothy Preston

Abstract — A 5-year-old spayed female German shepherd dog was referred for diagnostic evaluation and treatment of progressive exophthalmos, conjunctival hyperemia, and protrusion of the third eyelid of the left eye. Computed tomography revealed a retrobulbar mass of the orbit, exhibiting radio attenuation consistent with adipose tissue and well-defined margins. No evidence of metastasis was detected on thoracic radiographs or abdominal ultrasound. Cytological evaluation of ultrasound-guided fine-needle aspirates was inconclusive. A ventral transpalpebral anterior orbitotomy approach facilitated excision of the abnormal retrobulbar tissue. Histopathology revealed mature adipose cells compatible with a lipoma. The patient regained normal appearance and function 3 months after surgery.

Key clinical message:
While rare, consider a lipoma as a differential diagnosis for a retrobulbar mass. The ventral transpalpebral orbitotomy has been described in only 3 cases in the veterinary literature, and this is the only known report of utilizing this approach for excision of a neoplastic condition.

Due to the confined space of the orbit, a retrobulbar mass can result in various clinical signs. In a retrospective study of 25 small animal cases published in 2001, the most commonly identified signs were exophthalmos (84% of cases), conjunctival hyperemia (40%), protrusion of the nictitating membrane (28%), exposure keratitis (20%), and fundic abnormalities (20%) such as retinal detachment, edema, and vascular changes (1%). Etiologies for a retrobulbar mass include inflammatory causes (such as abscessation, cellulitis, trauma, and hematoma formation), immune-mediated conditions, orbital cyst-type lesions (such as sialoceles), vascular anomalies, emphysema, or neoplasia (2–10).

A lipoma is a benign tumor of mesenchymal origin arising from fat and is one of the more commonly diagnosed canine neoplasms. Lipomas could develop anywhere on the body within the subcutis (11) but could also develop in body cavities or...
deeper planes of fascia and muscle (4,11–13). These tumors can be asymptomatic but they can cause functional deficits when in specific locations, such as the orbit.

This report describes an orbital lipoma and highlights its rarity in anatomic location as well as the surgical approach. Surgical resection of an orbital lipoma in a dog was the focus of 1 previous case report (14). In that case, the lipoma was protruding from the dorsal conjunctival sac and accessible through a transconjunctival orbitotomy. In the present case, the retrobulbar space was accessed through the recently described ventral transpalpebral orbitotomy (15) and this is the first report of the excision of a benign neoplasm using this surgical approach.

Case description

A 5-year-old spayed female German shepherd dog was presented to the Atlantic Veterinary College (AVC) for evaluation of a 1-month progressive history of exophthalmos and protrusion of the third eyelid occlusus sinister (OS). A full ophthalmic examination was performed by a Board-certified veterinary ophthalmologist prior to referral. The patient had a 1-year history of pannus and corneal dystrophy occlusus uterque (OU); the pannus was managed with topical 1% prednisolone acetate (unknown brand) OU. Otherwise, the patient was considered to be in good systemic health. The patient was an active seeing eye guide dog and was dependent on vision for her work.

The patient was bright, alert, and responsive with all vital parameters within acceptable limits. Exophthalmos, conjunctival hyperemia, and protrusion of the third eyelid were observed OS (Figure 1A), and both eyes were assessed to have positive direct and consensual pupillary light reflexes and a positive bilateral menace response. No pain was evident upon local digital palpation or opening of the jaw, and no ocular or nasal discharge was noted. Retropulsion was decreased OS compared to occlusus dexter (OD). A complete blood cell count and serum biochemistry were performed, with results within reference ranges.

An ocular ultrasound was performed by a Board-certified veterinary radiologist with the patient under general anesthesia. A well-defined hypoechoic mass with multifocal areas of mixed echogenicity located posterior and slightly inferior to the left globe was identified. After preparation of the dorsal conjunctival fornix with 1:50 povidone-iodine solution, transconjunctival ultrasound-guided fine-needle aspirates were collected for cytological evaluation. Results were inconclusive as they were either primarily acellular or contaminated with a moderate amount of blood.

Computed tomography (CT) imaging (Aquilon TSX-101A; Toshiba Medical Systems Corporation, Tustin, California, USA) with 0.3-mm slices identified a hypoattenuating space-occupying retrobulbar mass of the left eye with similar Hounsfield units (−100 HU) to the surrounding retrobulbar fat OS and that of the right eye (Figure 2). Despite causing rostral, dorsal, and lateral displacement of the left globe, the mass appeared to have well-defined margins and normal-appearing surrounding anatomy, with no contrast enhancement. The mass caused ventral displacement of the ventral rectus muscle and dorsomedial displacement of the medial and dorsal rectus muscles, as well as dorsolateral displacement of the lateral rectus muscle and optic nerve. Further diagnostic imaging consisted of 3-view thoracic radiographs and an abdominal ultrasound, which did not reveal evidence of metastasis.

Based on CT results, a working diagnosis of a primarily lipid-based tumor was made, with no evidence of local or distant spread of disease. Excisional biopsy of the retrobulbar mass was therefore elected. The patient was premedicated with hydromorphone (Hydromorphone; Sandoz, Boucherville, Quebec), 0.05 mg/kg body weight (BW), IM and dexmedetomidine (Dexdormitor; Zoetis, Kalamazoo, Michigan, USA), 9 mg/kg BW, IM. General anesthesia was induced with alfaxalone (Alfaxan; Abbott Laboratories, Saint Laurent, Quebec), 1 mg/kg BW, IV, and maintained with isoflurane inhalant throughout the procedure. The patient was placed in sternal recumbency, and the surgery site was aseptically prepared with 1:50 povidone-iodine solution. Cefazolin (Fresenius Kabi Canada, Toronto, Ontario) was administered at 22 mg/kg BW, IV, every 90 min of surgery. Two stay sutures of 4-0 PDS
were placed on both the temporal and nasal aspects of the lower eyelid allowing the skin below the eyelid margin to remain taught. A 4-cm incision was then made approximately 1.5 cm below the inferior palpebral lid margin above the ventral orbital rim with a #15 surgical blade, providing a ventral transpalpebral anterior orbitotomy approach. Access to the ventral orbit was achieved through a combination of blunt dissection using Metzenbaum scissors, undermining of connective tissue and extending the skin incision 0.5 cm temporally. Two additional stay sutures were placed on both the dorsal and ventral aspects of the incision allowing for visualization of the rostral aspect of the mass, which was located below the ventral margin of the third eyelid. Care was taken to ensure the third eyelid and gland of the third eyelid were left intact; the approach was ventral to both of these structures, yet dorsal to the ventral orbital floor. A Lone Star Ring retractor (Jorgenson Laboratories, Loveland, Colorado, USA) was placed in the incision site to provide even, circumferential retraction of the incision (Figure 3). Care was taken to avoid excessive traction on the mass due to the proximity of the globe and the optic nerve. A 1 cm wide malleable retractor was also used when needed to apply gentle dorsolateral retraction on the globe. Due to the fatty nature of the mass, en bloc removal proved challenging, with the mass fragmenting easily when manipulated; a variety of surgical instruments were used. En bloc removal was successful with the use of a bladder spoon in conjunction with Adson tissue forceps. As the mass easily separated with minimal manipulation after removal, several pieces were submitted for histopathology. After excision of the mass, absorbable gelatin sponge (Surgifoam Ethicon, Somerville, New Jersey, USA) was placed behind the globe to minimize dead space and prevent enophthalmos after surgery, as a significant amount of the orbital fat pad was removed along with the mass. The third eyelid was replaced into anatomical position and sutured with 4-0 Monocryl (Ethicon), due to disruption of the ventral attachments of the third eyelid gland during blunt and sharp dissection. The deep subcutaneous tissue was closed with 4-0 Monocryl in a simple continuous pattern, and the dermis was apposed with 5-0 Monocryl in an intradermal pattern. Multiple sections of the mass were submitted for histopathology, the largest of which measured approximately 3 cm × 1 cm and accounted for approximately half of the total mass. All sections of tissue were histologically similar lobules of mature adipocytes supported by collagenous stroma. The adipocytes were of a uniform population of polygonal cells with distinct cell margins, abundant clear cytoplasm and a single large delinated cytoplasmic vacuole that displaced the small bland ovoid nucleus to the periphery of the cell, extending to the margins of the excised tissue. No mitotic figures were identified. Based on gross and histological findings, the mass consisted of mature adipose tissue, compatible with that of a lipoma.

Following recovery from general anesthesia, marked peri-orbital and conjunctival swelling, as well as moderate exophthalmos OS were present (Figure 1B). Fluorescein stain was retained OS and negative OD, indicating a superficial, axial corneal ulcer OS. The 1% prednisolone acetate used for the management of pannus OU by the referring veterinary ophthalmologist was temporarily discontinued and tobramycin 0.3%
topical ophthalmic solution (Tobramycin; Sandoz Canada) was administered OS q8h for 7 d. Post-surgical analgesia was provided with meloxicam (Metacam; Boehringer Ingelheim, St. Joseph, Missouri, USA), 0.1 mg/kg BW, PO, q24h for 5 d and gabapentin (Apothex, Toronto, Ontario), 11 mg/kg BW, PO, q12h to q8h for 5 d. Fluorescein stain performed 7 days after surgery was negative OU; tobramycin 0.3% ophthalmic solution was discontinued, and treatment for pannus with prednisolone acetate 0.1% ophthalmic solution OU was resumed.

The 4-week postoperative recheck revealed mild exophthalmos OS (Figure 1C), and the third eyelid was prolapsed, covering approximately 25% of the cornea. The Surgifoam which was placed within the retrobulbar space during surgery, was expected to slowly resorb over 4 to 6 wk, as per the manufacturer’s information. It was anticipated that the globe and third eyelid would return to a normal anatomic position over that period. Twelve weeks after surgery, the owner reported by telephone that the patient’s exophthalmos had resolved and there were no apparent visual deficits. The patient had a normal appearance 6 mo after surgery (Figure 1D).

Discussion
In a large retrospective study of humans, lipomas comprised less than 1% of total orbital lesions evaluated (16), making this condition rare among humans as well as among animals. The case presented here describes the unusual anatomic location for a lipoma, with only 1 other case report in the veterinary literature (14). Benign tumors represent only 10% to 25% of reported retrobulbar neoplasia (1) with other possibilities including meningioma, fibroma, and fibrous histiocytoma.

In this case, the patient had non-painful progression of unilateral exophthalmos over an approximately 4-week period, consistent with the progress of an orbital neoplastic condition (1,2,17). It should be noted that presence or lack of pain should not be a definitive factor in developing a complete differential diagnoses list, as swelling and pain can be present with tumor necrosis (2).

Differential diagnoses for a lipomatous orbital mass include an infiltrative lipoma, liposarcoma, and prolapsed orbital fat (18). Prolapsed orbital fat represents 2% of orbital lesions in humans (16), and has been reported in several veterinary patients (18,19). A significant difference between the orbital fat prolapse and a retrobulbar lipoma is the resulting mass effect. Patients with orbital fat prolapse develop enophthalmos, while those with a retrobulbar lipoma develop exophthalmos. Rare reports of orbital hibernomas, neoplasm of brown fat, have also been published recently and contribute to the list of differentials for a benign orbital mass (20,21).

Ventral transpalpebral anterior orbitotomy was chosen as the surgical approach in this case for several reasons. Firstly, based on the working diagnosis, a wide margin for excision was not indicated, so exenteration and orbitectomy were considered radical. Furthermore, the ventral transpalpebral orbitotomy decreased the likelihood of globe and optic nerve manipulation; osteotomies were avoided, and the approach facilitated adequate exposure to the ventromedial orbit and the retrobulbar space without extensive disruption of orbital tissues. Normal palpebral fissure anatomy was also maintained. This approach was first described in the veterinary literature in 3 canine cases by McDonald et al (15) for a retrobulbar abscess, a mucoceole, and necrotizing sialadenitis. One patient in that case series had blindness as a long-term complication due to an undetermined etiology, and another patient had a superficial corneal ulceration which resolved uneventfully, similar to the present case. McDonald et al (15) hypothesized that blindness as a postoperative complication was localized to a preganglionic lesion with possible etiologies including optic nerve compression, postoperative inflammation associated with the optic nerve, or surgical manipulation. In that case, optic nerve compression seemed most likely based on the significant mass effect of the mucoceole, and did not appear to be attributable to surgery (15).

A ventral transpalpebral anterior orbitotomy facilitates exposure of the ventral orbital floor and is appropriate for lesions in a similar location described in this report, as well as those described in the 2016 McDonald et al (15) case series. Until now, this surgical approach has not been reported in the treatment of a neoplastic condition. This approach may not be appropriate for disease processes that are more extensive or infiltrative, or which require adequate access to the lateral or dorsal orbital regions. None of the reported cases to date, including the present case, utilizing this surgical approach has had a recurrence of orbital disease within their follow-up time frames (2 y for the retrobulbar abscess and mucoceole cases, and 2 mo for the necrotizing sialadenitis case) (15).

In the only other reported orbital lipoma in the veterinary literature, a trans-conjunctival approach was performed (14) which may have resulted in less orbital exposure than the transpalpebral approach described here. Avoiding the third eyelid and the associated lacrimal gland may be possible in both approaches; however, less manipulation of the third eyelid was expected with the transpalpebral approach. Additionally, leaving the lid margin architecture intact is of significant benefit, as alterations to the lid margins can interfere with tear film distribution and therefore corneal health (22). As this patient already had a
progressive corneal disease (pannus), decreasing the likelihood of additional corneal irritation was a priority. With the transpalpebral approach there was no need for conjunctival suture, which was used in the transconjunctival approach. Conjunctival suture can result in additional corneal irritation depending upon its placement. Minimal hemorrhage was encountered in the case using the transconjunctival orbitotomy (14) and this may be a benefit as compared to the transpalpebral approach.

McDonald et al (15) reported that exophthalmos and soft tissue orbital swelling resolved within 2 wk of surgery in all 3 cases. In the case presented here, exophthalmos did not resolve until 4 wk after surgery. Considerations for the longer duration of postoperative exophthalmos and soft tissue orbital swelling include the use of Surgifoam (Ethicon) in the retrobulbar space and a difference in postoperative anti-inflammatory medication. McDonald et al (15) administered oral prednisone after surgery (with initial doses ranging from 1.0 to 2.2 mg/kg BW per day) for anti-inflammatory purposes; whereas in our case, a non-steroidal anti-inflammatory drug (NSAID) was used to manage postoperative inflammation. Non-steroidal anti-inflammatory drugs are known to be less potent than corticosteroids with regard to their anti-inflammatory properties (23). Our decision to manage postoperative pain and inflammation with an NSAID was to avoid potential decreased wound healing time and to avoid side effects commonly associated with steroid administration. Meloxicam was a good option in this case as it has been shown efficacious for postoperative soft tissue analgesia and inflammation (24–27).

While the primary indication for Surgifoam, a porcine gelatin absorbable sponge frequently used in both human and veterinary surgery, is for hemostatic purposes, intra-operative hemorrhage in this case was controlled with electro-cautery and direct pressure. The Surgifoam that was inserted into the retrobulbar space was used to prevent postoperative enophthalmos, which likely contributed to moderate exophthalmos OS for several weeks after surgery; this exophthalmos was no more severe than what was present before surgery. The sponges are expected to be compressed and resorbed over 4 to 6 wk. In our case, it was expected that a near-normal appearance to the patient’s orbit and globe would be achieved within that time frame. Porcine-derived hemostatic sponges have been determined to be safe for use in veterinary patients as persistent postoperative complications and hypersensitivity reactions, while reported in humans, do not appear to occur with any significant frequency in veterinary patients (28).

In the case herein, transient expansion of the Surgifoam was expected to potentially result in exophthalmos rather than impacting the retrobulbar tissues such as the optic nerve. This may be due to the anatomy of the canine orbit and the incomplete bony enclosure, allowing some degree of outward soft tissue expansion. However, this should still be recognized as a potential risk for using a hemostatic sponge in the retrobulbar area. Some degree of retraction of the orbital soft tissues was also expected in the later postoperative period due to fibrosis, which increased the concern for postoperative enophthalmos and supported our decision to leave the Surgifoam in the retrobulbar space at the time of surgery. This was in contrast to the report by Alander et al (29) to not leave Surgifoam in a confined space.

This case is the second report of an orbital lipoma in the veterinary literature, and the first report of a ventral transpalpebral orbitotomy for surgical treatment of a neoplastic process. This surgical approach should be considered in cases of focal, non-invasive retrobulbar disease and for acquiring incisional or narrow margin excisional biopsy which increases the likelihood of a definitive diagnosis. Fortunately, exenteration of the orbit and removal of a visual eye was avoided in this case owing to a thorough pre-operative diagnostic evaluation and application of this surgical approach.

References


Answers to Quiz Corner
Les réponses du test éclair

1. E) Amphotericin B is nephrotoxic. It is directly toxic to the renal tubular epithelium and causes renal vasoconstriction, decreasing the glomerular filtration rate. Patients need intravenous fluid diuresis before the administration of amphotericin B.

   E) L’amphotérincine B est néphrotoxique. Elle est directement toxique pour l’épithélium tubulaire rénal et elle cause une vasoconstriction rénale, ce qui diminue le débit de filtration glomérulaire. Les patients ont besoin d’une fluidothérapie intraveineuse diurétique avant l’administration d’amphotérincine B.

2. B) A pressure of less than 15 mmHg is considered hypotony, and a pressure greater than 25 mmHg is not consistent with normal function of the optic nerve.

   B) Une pression inférieure à 15 mmHg est considérée comme une hypotonie, et une pression supérieure à 25 mmHg n’est pas compatible avec la fonction normale du nerf optique.

3. C) Campylobacter enteritis is very common and these organisms can also be animal pathogens. Although the mechanisms for the development of Guillain-Barré Syndrome are not fully understood, and the syndrome can be triggered by a variety of associations, the relationship to campylobacteriosis is medically acknowledged.

   C) L’entérite à Campylobacter est très commune et cet organisme peut également être pathogène pour les animaux. Bien que les mécanismes pour le développement du syndrome de Guillain-Barré ne soient pas complètement connus et que le syndrome puisse être déclenché par diverses associations, la relation avec la campylobactériose est médicalement reconnue.

4. C) The dexamethasone suppression test is the test of choice for diagnosis of pars intermedia dysfunction.

   C) Le test de suppression par la dexaméthasone est le test de prédilection pour le diagnostic de la dysfonction du lobe intermédiaire de l’hypophyse.

5. E) Although all can cause subcutaneous emphysema, escape of intraperitoneal free air after a standing flank laparotomy is common if the peritoneal closure is imperfect. It presents with no other signs, and usually resolves without complications.

   E) Bien que tous les problèmes énumérés puissent causer de l’emphysème sous-cutané, la libération de l’air libre intra-peritonéal après une laparotomie par le flanc en position debout est fréquente si la fermeture de l’incision péritonéale est imparfaite. Cette libération d’air se présente sans autres signes et disparaît habituellement sans complications.
Cranial tibial fascia autograft for wound closure following hemipelvectomy in a cat

Darren C. Barnes, Robert J. Quinn

Abstract — A 13-year-old cat underwent an extensive caudal external hemipelvectomy to excise a soft tissue sarcoma affecting the left proximal thigh. The cranial tibial fascia was harvested from the ipsilateral limb following amputation and used as a free graft in the reconstruction of the resultant pelvic and abdominal wall defect. Wound healing was uncomplicated, and 6 months following surgery there was no evidence of tumor recurrence or loss of integrity of the abdominal wall or lateral rectal support.

Key clinical message:
The cranial tibial fascia appears to be an effective autograft tissue for reconstructive surgery and may be applicable for closure of extensive hemipelvectomy procedures performed for tumors affecting the femoral region.

Hemipelvectomies of different extent have been previously categorized (1). The use of the sartorius muscle for abdominal wall closure has been advocated following caudal external hemipelvectomy with tumors caudal to the femur, and semi-membranosus/semitendinosus muscle flaps for closure following cranial external hemipelvectomy with tumors located cranial to the femur (1).

More extensive tumors requiring resection of both these muscle groups within the surgical margin result in limited to no local tissue availability to prevent subsequent abdominal herniation through the open lateral aspect of the remaining pelvis. Alternative options for reconstruction of the resultant defect might include using muscle flaps from the contralateral hemipelvis, prosthetic mesh, porcine small intestinal submucosa, or autologous fascia grafts. Myocutaneous flaps have been reported to aid wound closure in humans (2). Use of prosthetic mesh for reconstructive surgery has been associated with surgical site infection, adhesions, and adverse host tissue reaction (3). Use of autologous fascia from previously identified locations, such as the fascia lata or thoracolumbar fascia is associated with additional dissection and morbidity, increasing that of an already substantial procedure.

This report describes the novel use of the cranial tibial fascia harvested from the distal aspect of the amputated limb for wound reconstruction.

Case description
A 13-year-old neutered male domestic shorthaired cat was presented following a 6-week history of left hind limb lameness. On examination, the patient was in slim body condition, with a large firm mass lesion expanding the proximal left thigh, and a grade II/VI left-sided heart murmur.

Routine complete blood (cell) count (CBC) and serum biochemistry performed following admission revealed a mild anemia (hematocrit: 0.24 L/L) but were otherwise unremarkable.

Dick White Referrals, Station Farm, London Road, Six-Mile Bottom, Newmarket, Cambridgeshire CB8 0UH, UK.
Address all correspondence to Mr. Darren C. Barnes; e-mail: db@dwr.co.uk

Use of this article is limited to a single copy for personal study. Anyone interested in obtaining reprints should contact the CVMA office (hbroughton@cvma-acmv.org) for additional copies or permission to use this material elsewhere.
Echocardiography showed no evidence of structural heart disease. The murmur was proposed to likely be caused by dynamic right ventricular outflow tract obstruction, and treatment was not considered necessary.

Pre- and post-contrast enhanced computed tomography (CT) images of the thorax and abdomen, including pelvis and proximal hind limbs, were acquired in overlapping 1-mm thick transverse slices (Figure 1).

A large (80 × 63 × 61 mm), multicavitated mass extended circumferentially around the left femur, from the left coxofemoral joint to the distal 3rd of the left femur. This lesion was slightly hypoattenuating, and mildly rim-enhancing. The mass appeared to invade the following muscles: internal obturator, gemelli, all components of the left quadriceps femoris, adductor magnus and brevis, and the biceps femoris. The glutaeals, gracilis, semimembranosus and semitendinosus, and the sartorius muscles appeared unaffected, but each of these muscles contacted the mass. The left femoral diaphyseal cortex was diffusely thickened circumferentially, and there were small areas of lysis within the left greater trochanter and proximal cortical diaphysis. A small, irregularly margined, hyperattenuating area was present at the proximal 1/3 of the left femur, immediately distal to the nutrient foramen, suspected to be a medullary bone infarct. Irregular periosteal bone extended circumferentially along the proximal 2/3 of the left femoral diaphysis. The left femoral head was diffusely hyperattenuating compared to the contralateral limb, but the left coxofemoral joint was unremarkable. The left

Figure 1. Dorsal (a), transverse (b), and sagittal (c) CT slice images in soft tissue window following contrast administration illustrating the extent of tumor growth within the proximal left femoral region.

Figure 2. Surgical field following amputation and caudal external hemipelvectomy of the left side of the pelvis, with the patient in right lateral recumbency.
popliteal lymph node was slightly rounded but homogeneous, measuring 3.6 mm thick.

Additional abnormalities noted were as follows: a small, strongly hyperattenuating 5 mm focal area within the tip of the right middle lung lobe, suspected to represent a focal area of pneumonia; marked generalized ventrolateral spondylosis deformans; a few small, well-defined, nondeforming, hypointensifying and noncontrast-enhancing nodules distributed within the splenic parenchyma; a small, sharply defined, hypointensifying noncontrast enhancing lesion within the left renal cortex, interpreted as an incidental renal cyst; diffusely rounded, enlarged adrenal glands, measuring up to 7.6 mm on the left and 8.3 mm on the right; enlarged and heterogeneous jejunal, right and left colic lymph nodes, all measuring up to 6.5 mm thick with small cavitations; and incidental bifurcation of the caudal vena cava caudal to the renal veins.

Cytology of fine-needle aspirates taken from the left hind limb mass was suggestive of a sarcoma. The inguinal lymph node showed reactive lymphoid hyperplasia, and splenic aspirates suggested lymphoid reactivity with no evidence of metastatic disease in either of these locations.

The patient was typed as blood group A prior to surgery. In preparation for surgery, a lumbosacral epidural was performed using levobupivacaine (Chirocaine; AbbVie, Maidenhead, UK) and morphine sulphate (Macarthys Laboratories, Romford, UK). A rectal purse-string suture and an indwelling urinary catheter were placed.

A caudal external hemipelvectomy was performed using an oscillating saw, sectioning the pubis on midline, and the ilial body just caudal to the sacrum. The sartorius, and middle and deep gluteal muscles were subperiosteally elevated from the ilial wing. The superficial gluteal was cut close to its origin. The internal obturator was removed with the left hemipelvis. The iliopsoas was sectioned at the cranial extent of the ilium. The resultant pelvic defect exposed the rectal wall, supported only by the coccygeus and levator ani muscles caudally, and allowed abdominal fat and visceral herniation (Figure 2).

A surgical assistant used separate operative equipment away from the surgical field to harvest the cranial tibial fascia, which was previously determined to be outside of the surgical margins of the mass (Figure 3). The graft was lavaged, and then sutured into the pelvic defect using simple interrupted sutures of 3-0 polyglyconate, and anchored via bone tunnels drilled

![Figure 3. Exposure of (a) and elevation of (b) the cranial tibial fascia via a separate skin incision remote from proximal femoral tumor.](image1)

![Figure 4. Placement (a) and securing (b) of the free fascial allograft to the abdominal and pelvic wall dissection.](image2)
along the cut edge of the pubis and the ilium, as well as to the prepubic tendon, abdominal wall musculature, coccygeus and cut edges of superficial gluteal, and iliopsoas muscles (Figure 4). Wound closure was routine, with subcutaneous and intradermal continuous layers using 4-0 poliglecaprone 25.

Following surgery, an epidural catheter was placed to provide post-operative analgesia in the form of levobupivacaine, as dictated by assessment using a modified Glasgow pain score. The patient made an uneventful recovery from surgery. Hematocrit was reassessed as 0.18 L/L the day following surgery. The patient was discharged 3 d after surgery following removal of the epidural and urinary catheters with instructions for strict crate rest for 2 wk and use of an Elizabethan collar to prevent interference with the wound. Amoxicillin/clavulanate (Synulox; Zoetis, Tadworth, UK), 20 mg/kg body weight (BW), PO, q12h was administered for 5 d and meloxicam (Metacam; Boehringer Ingelheim, Bracknell, UK), 0.05 mg/kg BW, PO, q24h was administered for 7 d.

Reassessments were made at 7 and 14 d following surgery. The cat’s owner reported good progress since surgery, and there were no concerns. Specifically, there was no difficulty in urinating or passing stools, although posturing had been challenging at first. The patient’s mobility greatly improved over the 2 wk following hospital discharge. The cat was comfortable on palpation at the surgical site. The surgical incision became mildly inflamed by 14 d following surgery due to the cat escaping his Elizabethan collar repeatedly and licking the surgical site. A further 5 d of amoxicillin/clavulanate (100 mg twice daily) and topical fucidic acidic ointment (to be applied twice daily) were dispensed.

Histopathology revealed the mass to be a rhabdomyosarcoma. The proximal margin was reported to be clean but close; however, the narrow nature of the margin was suspected to have been exacerbated by tissue plane displacement during fixation and processing. Importantly, assessment of the graft harvest site revealed wide margins from the tumor. Options discussed included i) benign neglect and monitoring; ii) follow-up adjuvant chemotherapy; iii) adjunctive immunotherapy. The client considered these options and opted for the first option.

Six months after surgery, the cat was reported to be in excellent general health, having returned to his local veterinarian only for dental treatment recently. The cat remained very mobile on 3 limbs, with no difficulty toileting, and no recurrence of the tumor or swelling at the surgical site has been noted at this stage.

Discussion

This report describes the novel salvage of fascia associated with the distal limb following caudal external hemipelvectomy with amputation in order to facilitate wound reconstruction. Whilst no post-operative imaging was performed in this case, the cat recovered clinically well from surgery, and there has been no evidence of loss of integrity of the graft tissue or loss of function. Hence, we may consider the procedure to have been clinically appropriate.

The concept of distal tissue salvage following proximal limb tumor resection is perhaps most overtly demonstrated in humans undergoing rotationplasty procedures (4,5). Cranial tibial fascia was reported as a graft material previously in a single case for the reconstruction of the long digital extensor tendon in a dog (6). In that case, the graft was harvested locally within the surgical exposure for tendon repair. Whilst there are no recorded data for the size of graft available for harvest or the durability of that tissue in veterinary medicine compared with fascia harvested at other sites, the tissue harvested appeared to be of sufficient size and strength for the desired role in reconstruction in this case.

Alternative options for wound closure could have been considered in this case, such as sparing the sartorius muscle bellies to use to reconstruct the wound. However, the proximity of these structures to the mass, and a lack of certainty from CT as to whether these structures were invaded versus only in contact, made resection the option most likely to achieve clean surgical margins. Alternatively, use of a prosthetic mesh implant was considered, and was planned as a reserve option if the cranial tibial fascia was not of sufficient size or durability. This option was not preferred due to the risk of surgical site infection, and enterocutaneous fistulation if in direct contact with the rectum. This risk could have been mitigated by lining with omentum; however, this, as well as harvest of other autologous tissues, would have increased surgical time, exposure, and morbidity, and was, therefore, not favored over the reported technique.

References

Intermittent urethral obstruction secondary to caudal sliding of a pelvic bladder in 3 dogs

Caroline Benzimra, Magali Decôme, Christelle Maurey, Eddy Cauvin, Jérôme Couturier, Audrey Belmudes, Delphine Rault

Abstract — Three Yorkshire terrier dogs (2 males and 1 female) were presented for investigation of chronic dysuria and stranguria. Physical examination was unremarkable except for a poorly filled bladder. Biological tests, urinalysis, ultrasound, and routine radiography detected no significant abnormality, except for intermittent displacement of the bladder in the pelvis. Manual voiding cysto-urethrography showed marked caudal displacement of the bladder without perineal hernia and revealed intermittent, dynamic urethral obstruction. Obstructive kinking of the membranous urethra was observed in male dogs, and the marked caudal displacement of the bladder in the female dog was suspected to induce similar urethral obstruction, although this was not clearly visualized because of the absence of contrast filling of the obstructed urethra. All dogs showed resolution of the clinical signs following cystopexy.

Key clinical message:
This report documents the diagnostic value of manual voiding cysto-urethrography for the investigation of dynamic voiding disorders, especially in dogs with a pelvic bladder.

Résumé — Obstruction urétrale intermittente secondaire au glissement caudal d’une vessie pelvienne chez trois chiens. Trois chiens de race Yorkshire (2 mâles et 1 femelle) furent présentés pour un problème de dysurie chronique et de strangurie. L’examen physique ne révéla rien d’anormal sauf une vessie pauvrement remplie. Des tests biologiques, une analyse d’urine, une échographie et des radiographies de routine ne détectèrent aucune anormalité, sauf pour le déplacement intermittent de la vessie dans le pelvis. Une cysto-urétrographie avec vidange manuelle a montré un déplacement caudal marqué de la vessie sans hernie périnéale et a révélé une obstruction urétrale dynamique et intermittente. Une plicature obstructive de l’urètre membraneuse fut observée chez les chiens mâles, et le déplacement caudal marqué de la vessie chez la chienne fut soupçonné d’induire une obstruction urétrale similaire, bien que ceci n’était pas clairement visualisé étant donné l’absence de remplissage par le milieu de contraste de l’urètre obstruée. La résolution des signes cliniques fut observée chez tous les chiens suite à la cystopexie.

Message clinique important :
Ce rapport documente la valeur diagnostique d’une cysto-urétrographie avec vidange manuelle pour l’étude de désordres de vidange dynamiques, spécialement chez les chiens avec une vessie pelvienne.

(Traduit par Dr Serge Messier)

Pelvic bladder refers to a bladder neck located caudal to the pubis with abrupt blunting of the bladder neck (1). It can be associated with urinary signs or be an incidental finding in clinically normal dogs (2). When associated with clinical signs, a pelvic bladder is usually associated with urethral sphincter mechanism incompetence and urinary incontinence (1). This occurs more commonly in spayed bitches (1).

In a recent case report, an atypical clinical manifestation of pelvic bladder was described, in which severe caudal displacement of the urinary bladder within the pelvic canal resulted in dynamic urethral kinking, associated with stranguria and intermittent anuria (3). In the current case report, 3 additional cases of dysuria in dogs with pelvic bladder are described, documenting the clinical presentation and possible predisposing factors of this atypical cause of urethral obstruction.

Case description

Case 1
Dog 1, a 13-year-old, castrated male Yorkshire terrier, was presented for investigation of intermittent stranguria of 2-week’s duration. Medical treatment with antibiotics [amoxicillin and clavulanic acid (Kesium; Ceva, Libourne, France)], 12.5 mg/kg body weight (BW), PO, q12h and antispasmodics (phlorogluclavulanic acid (Kesium; Ceva, Libourne, France)], 12.5 mg/kg BW, PO, q12h, failed to improve the condition. The dog also had a history of acute episodes of diarrhea with tenesmus, the last of which had occurred 1 wk prior to the onset of the urinary signs, and chronic cough due to tracheal collapse.

The referring veterinarian reported an inability to induce micturition by manual expression of the urinary bladder; however, urethral catheterization was reported as effortless. Abdominal radiographs obtained before referral revealed a pelvic bladder.

Physical examination was normal, except for an inability to detect the bladder on palpation. Rectal palpation identified no abnormalities and showed no evidence of a perineal hernia. The results of serum laboratory tests and urinalysis from urine samples obtained through cystocentesis were unremarkable.

Abdominal ultrasound examination was performed using a 4.2–10.2 MHz micro-convex array transducer (Aploio 400; Toshiba, Tochigi, Japan) in resolution mode. Ultrasonography showed poor distension of the urinary bladder and a pelvic location of the bladder neck. The presence of nephroliths, measuring up to 4 mm, in the renal pelvises and small prostatic cysts, was also noted.

One month later, computed tomography (CT) of the thoracolumbar spine and pelvis was performed due to lack of improvement in clinical signs. The examination was performed under general anesthesia, using a dual slice spiral CT scanner (Toshiba Aquilion 64; America Medical System, Tustin, California, USA). The patient was positioned in dorsal recumbency. Unenhanced acquisition of the spine from T2 to S1 was performed (1 mm thick, contiguous slices, kVp: 120; mAs: 200; collimator pitch: 1 mm; rotation time: 0.75 s; matrix: 512 × 512). After intravenous injection of ioxitalamate (Telebrix 35, 350 mg of iodine/mL; Guerbet, Roissy, France), 2 mL/kg BW, contrast-enhanced images were obtained after a 120 s delay. No abnormalities were detected in the vertebral spine and spinal cord. The urinary bladder was moderately distended and had a normal, intra-abdominal location. The urethral path was unremarkable.

Retrograde urethrography was subsequently performed using a high frequency radiographic tube with a rotating anode (Super 80CP Philips CA; Suresnes, France) with a digital radiography flat panel detector (Aria DR7c, SIV; Orsay, France). Five milliliters of ioxitalamate (Telebrix 35, 350 mg of iodine/mL; Guerbet) were injected through a urinary catheter, whose extremity was placed distal to the us penis. Retrograde urethrography showed adequate urethral filling without parietal or endoluminal lesion. There was no evidence of urethral stenosis. Pelvic location of the bladder neck and prostate, mild ampullar dilation of the prostatic urethra and mild intraprostatic reflux of contrast medium were observed (Figure 1A).

An attempt was then made to perform voiding cystourethrography by applying continuous manual pressure on either side of the caudal abdomen with both hands, protected with lead-gloves. For radioprotection considerations, the beam was collimated to include the caudal abdomen and pelvis yet exclude the covered hands of the operator. The applied pressure was similar to that used when attempting to manually void a bladder. This failed, however, to cause urination. The radiographs thus obtained showed marked caudal displacement of the urinary bladder through the pelvic canal and caudal displacement of the prostate toward the perineum, resulting in abrupt interruption of contrast medium filling of the lumen of the caudal pelvic urethra (Figure 1B). Moderate dilation of the bladder neck and prostatic urethra was also noted. Repeat radiographs after abdominal pressure was released showed that the bladder had returned to its usual position in the caudal abdomen. The bladder was subsequently easily emptied via catheterization. Based on these imaging features, caudal displacement of the urinary bladder into the pelvis during a conscious attempt to urinate, leading to urethral kinking, was suspected to result in complete obstruction of the urethra and transient inability to urinate.

Cystostomy and deferentostomy were performed on the following day. No abnormality of the urinary bladder ligaments was noticed during surgery. The patient recovered well and was discharged the next day, with a 5-day course of meloxicam (Metacam; Boehringer, Burgdorf, Germany), 0.2 mg/kg BW, PO, q24h. The owner reported complete resolution of the lower urinary tract clinical signs after a few days.

At a 6-month follow-up examination, the dog was free of urinary signs. Ultrasonographic examination at this time showed a normally filled intra-abdominal urinary bladder with an antepelvic neck.

Case 2
Dog 2, a 9-year-old, castrated male Yorkshire terrier, was presented for investigation of repeat, unsuccessful micturition attempts and stranguria of 1-week’s duration. The dog had a history of tracheal collapse. A secreting adrenal adenoma associated with Cushing’s syndrome had been surgically treated by unilateral adrenalectomy, coupled with cystotomy for the removal of calcium oxalate uroliths 1 mo earlier.
Physical examination was unremarkable, except for poor bladder distension. No evidence of a perineal hernia was noted during rectal palpation. Results of serum laboratory tests and urinalysis from urine samples obtained by cystocentesis were normal.

Abdominal ultrasound showed poor distension of the urinary bladder and a pelvic bladder neck, an enlarged hyperechoic liver, most likely consistent with steroid hepatopathy, mild renal lithiasis, and an absent right adrenal gland consistent with prior adrenalectomy.

Retrograde urethrography followed by voiding cystourethrography was performed under general anesthesia, as described for dog 1. Catheterization of the urinary bladder was unremarkable. The catheter was then withdrawn in order to place its tip caudal to the os penis, and urethrography was again performed. No resistance was noted during the injection of contrast medium into the catheter. Retrograde urethrography showed a pelvic location of the bladder neck and prostate, mild ampullar dilation of the prostatic urethra, yet normal filling of the entire urethra by contrast medium. No evidence of urethral stenosis was observed during the procedure. During voiding cysto-urethrography, we were unable to induce micturition. Caudal displacement of the urinary bladder through the pelvic canal and filling defect of the caudal pelvic urethra were observed. To visualize the dynamic component of the urethral obstruction, fluoroscopic examination was performed using the same voiding procedure (OEC Fluorostar 7900 Digital Mobile C-arm; General Electric, Chalfont St. Giles, Buckinghamshire, United Kingdom). On neutral radiographs, the bladder neck was in an antepubic location (Figure 2A). When applied, the abdominal pressure resulted in intermittent micturition and in marked caudal displacement of the bladder into the pelvic canal, with the bladder neck located at the level of the mid pelvic cavity (Figure 2B). Once the bladder was displaced into the pelvic canal, the membranous urethral lumen appeared filled in and S-shaped (Figure 2B-1), concurrent with brief and interrupted micturition. As the manual pressure was maintained to try to obtain continuous micturition, the urinary bladder slid more caudally, associated with interruption of contrast medium filling of the membranous the urethra with concomitant interruption of micturition (Figure 2B-2).

Following these imaging studies, a diagnosis of dynamic urethral narrowing and kinking secondary to caudal displacement of the bladder into the pelvic canal was made. This was associated with intermittent urethral obstruction. Medical treatment consisting of midazolam (Midazolam; Mylan, Saint-Priest, France), 0.2 mg/kg BW, PO, q12h and prazosin (Minipress; Cutis, Allau, France), 0.05 mg/kg BW, PO, q12h, was prescribed, but resulted in only partial improvement of the clinical signs. A cystopectomy was subsequently performed 7 d after institution of medical therapy. The surgeon did not detect any injury to the urinary bladder ligaments. The surgery resulted in resolution of the clinical signs, without recurrence at 1-month follow-up.

Figure 1. Positive-contrast cysto-urethrography in dog 1. A — Standard, right lateral radiograph of the caudal abdomen: the bladder neck was located within the pelvis, and mild ampullar dilation of the prostatic urethra is visible. B — While applying pressure to the caudal portion of the abdomen, the bladder was displaced further caudally, and the caudal pelvic urethra became markedly kinked with an associated filling defect in the urethra caudal to the folded portion.
Case 3
Dog 3, a 9-year-old, ovariectomized female Yorkshire terrier, was presented for the investigation of intermittent urinary incontinence of 6-month’s duration, alternating with dysuria consisting in prolonged micturition efforts, stranguria, and an intermittently abnormal gait. The dog had a history of tracheal collapse and previously diagnosed multifocal, chronic cervical intervertebral disc disease.

No abnormalities were detected on physical examination, rectal palpation, and neurologic examination. The urinary bladder was poorly distended. Results of serum laboratory tests and analysis of urine samples obtained by cystocentesis were unremarkable.

The dog underwent thoracolumbar and pelvic CT (Toshiba Aquilion 64; America Medical System), under general anesthesia, as described for dog 1. Multifocal disc herniations in the thoracic and lumbar segments of the vertebral spine were observed. Some protrusions were associated with mild to moderate spinal cord compression. Given the absence of paraparesis and the mild to moderate degree of spinal cord compression, disc herniations were considered unlikely to induce micturition disorders. The urinary bladder was mainly located within the pelvis and extended to the level of the ischiatic tuberosity. The caudal aspect of the bladder remained in a median location and the muscular perineal diaphragm was intact bilaterally.

Abdominal radiographs were obtained immediately after CT examination, allowing visualization of the contrast-enhanced urinary bladder. The caudal half of the urinary bladder was located within the pelvic canal, extending to the level of the ischiatic tuberosity. The bladder neck and urethra were not identified (Figure 3A).

Voiding cysto-urethrography was performed as described for dogs 1 and 2. The entire bladder was located within the pelvis and partially extended caudal to the ischiatic tuberosity. There was no filling of the urethra and the urethral path could not be visualized (Figure 3B). Marked caudal displacement of the urinary bladder into the pelvis toward the perineum, leading to obstructive urethral compression and possible urethral kinking was suspected. Based on the severity of this displacement, surgery was recommended.

Left-sided cystopexy and right-sided uteropexy were performed. A pre-existing tear of the median ligament of the urinary bladder was noted during the procedure. The dog recovered well and was discharged, with a 7-day course of meloxicam (Metacam; Boehringer), 0.2 mg/kg BW, PO, q24h. The owner reported the complete resolution of lower urinary tract symptoms the following week. There was no recurrence of clinical signs 6 mo later.

Discussion
This report presents 3 cases of presumed dynamic obstruction of the pelvic urethra, secondary to intermittent marked caudal displacement of a pelvic bladder, with no sign of perineal hernia. Similar dynamic obstruction of the urethra was described in a 15-year-old spayed female dog (3). In this previous case report, cysto-urethrography with fluoroscopy identified a pelvic bladder, a tortuous path of the urethra and invagination of the urinary bladder wall. Caudal displacement of the urinary bladder resulting in kinking of the proximal portion of the urethra was highlighted through the application of gentle abdominal pressure (3). In both reports, the term “kinking” was suggestive of an obstructive plication of the urethra, leading to intermittent
urinary obstruction; this obstruction was either confirmed using imaging procedures (such as fluoroscopic examination in dog 2) or presumed on the basis of both imaging findings and intermittent inability to induce micturition while abdominal pressure was applied. Additionally, similar difficulty to void, caudal displacement of the bladder, and secondary kinking of the vesico-urethral junction during voiding cysto-urethrography have also been described in a Yorkshire terrier which had undergone bilateral perineal hernia repair 7 mo earlier (4).

Kinking of the urethra could represent a new cause of dysuria in canine patients. Dysuria can be due to anatomical disorders such as calculi, neoplasia, stenosis, or functional disorders. Kinking of the urethra was previously reported and can represent a new cause of urethral obstruction. It is noteworthy that urethral catheterization was easy in our male dogs and the practitioner could not rule out urethral kinking based on urethral catherization.

All reported cases of dynamic urethral obstruction share the finding of an intermittent pelvic bladder. The congenital or acquired nature of the pelvic bladder in these patients could not be determined. However, pelvic bladder is thought to be congenital in veterinary medicine (1,2).

All reported cases presented with a history of a condition that could result in increased abdominal pressure, such as multiple parturitions (3), chronic cough secondary to tracheal collapse (reported in all the cases in our series), episodes of colitis (dog 1) or tenesmus following surgical repair of a perineal hernia (4). There was no evidence of perineal hernia during rectal examination, imaging, or surgical procedures in the current cases. Nevertheless, there was probably some degree of weakening or disruption of the supportive ligaments of the bladder, leading to its abnormal caudal displacement. Among our cases, only dog 3 exhibited a tear of the median urinary bladder ligament, possibly associated with prior ovariectomy, and no bladder ligament injury has been reported in previous publications (3,4). Although this ligament tear may have contributed to the caudal mobility of the urinary bladder in dog 3, caudal displacement of the bladder secondary to ligament tear seems unlikely in the other cases. Nonetheless, chronic weakening of the urinary bladder ligaments or the supportive connective tissues of the pelvis secondary to chronically increased intra-abdominal pressure can also be considered to contribute to the abnormal mobility of the bladder in these dogs. Finally, the congenital or acquired nature of the pelvic bladder in these middle aged or old dogs remains unclear. However, the age at the onset of clinical signs may be more in favor of an acquired process.

An intrinsic ability of pelvic bladders to slide caudally into the pelvic canal is another hypothesis to be considered, making pelvic bladder a potential predisposing factor for dynamic urethral obstruction. The absence of clinical signs in most dogs diagnosed with a pelvic bladder (most often an incidental finding) does not, however, support this hypothesis. Potential mobility or changes in position of pelvic bladders during micturition or with increased abdominal pressure have been poorly documented in the veterinary literature. In this series, abdominal ultrasound, CT examination, and retrograde urethrography
showed no evidence of urethral obstruction. The diagnosis was exclusively based on voiding cysto-urethrography (with or without fluoroscopy), performed by applying manual pressure on the caudal abdomen. This procedure highlighted dynamic caudal displacement of the pelvic bladder and pelvic urethral obstruction. Voiding cysto-urethrography has been previously used alone for the radiographic evaluation of the canine urethra or coupled with cystometry or uroflowmetry for the investigation of micturition disorders (5,6). In a previous radiographic study of the urethra of normal dogs, a flexure of the caudal pelvic urethra was reported in 3 out of 9 male dogs during retrograde and voiding cysto-urethrography, regardless of the pelvic or abdominal location of the bladder neck (5). This flexure did not alter contrast filling of the urethra, as all male dogs in the study exhibited a smooth and homogeneous urethral diameter in the caudal pelvic and extrapelvic segments of the urethra during voiding cysto-urethrography (5). The S-shape and marked intermittent interruption of contrast medium in the caudal pelvic urethra of dogs 1 and 2 in our series during manual voiding cystourethrography differ from previously described urethral flexure and was consistent with urethral kinking.

In the current report, urethral kinking was observed in association with marked caudal displacement of the urinary bladder while manual pressure was applied to the caudal abdomen. Voiding urethrography performed by applying pressure on the abdomen (also called antegrade or normograde urethrography) is a non-standardized technique sporadically described in textbooks and other publications (7,8). The radiographic appearance of the urethra using this technique has been poorly documented. Nevertheless, marked caudal displacement of the bladder or significant urethral kinking has not been previously reported as an incidental finding with this procedure. In our cases, the pressure applied to the caudal abdomen was subjectively considered to be sufficient to induce micturition; as it was thought to be equivalent to the pressure usually applied while attempting to void a bladder under general anesthesia, the authors consider it unlikely that it could have induced the observed urethral intermittent obstruction. Definitive confirmation of the clinical relevance of the abnormal mobility of the urinary bladder and path of the urethra would require a comparison with a control population of healthy Yorkshire terriers undergoing voiding cystourethrography. A prospective study evaluating the feasibility and repeatability of this radiographic technique is required. Despite this lack of controls, the authors consider the displacement of the bladder and the abnormal path of the urethra as clinically relevant in the present cases. The description of a similar dynamic urethral obstruction in a dog (3) and the absence of significant abnormality in biological tests and static imaging modalities support the clinical significance of the urethral obstruction associated with caudal displacement of the bladder. The resolution of the clinical signs in all the dogs following cystoscopy also supports this presumed diagnosis.

Additionally, in these 3 dogs as in the previously reported case, pressure-induced urethral kinking was associated with dynamic obstruction of the urine flow, which was consistent with the clinical signs exhibited by the patients. All of these animals had dysuria and repeated or prolonged conscious attempts to urinate, suggestive of urethral obstruction. However, the poor filling of the urinary bladder observed during physical examination suggested patency of the urethra, and so was more in favor of intermittent urinary obstruction than of complete obstruction. Fluoroscopic examination performed in dog 2 showed the intermittent nature of the obstruction, associated with dynamic, S-shaped kinking of the membranous urethra. It also confirmed that the urethra was patent, with no evidence of stenosis. Although the urinary bladder was small in the dogs herein during physical examination, thus ruling out complete urethral obstruction, it was adequately distended during contrast radiographic studies. This finding supported a normal repletion capacity of the urinary bladder in these animals. However, this distension was artificially induced by standard recommendation of contrast volume instillation for contrast studies.

In this series, the selected imaging procedures did not allow us to rule out other potential causes of intermittent lower urinary tract obstruction, such as reflex dyssynergia, urethral spasms, or functional urethral obstruction (9). Cystometric and uroflowmetry profiles could have been performed to rule out these hypotheses. Since mechanical obstruction associated with urethral kinking had been diagnosed and was supported by resolution of the clinical signs after cystoscopy, such functional disorders were considered less likely. However, resolution of the clinical signs following cystoscopy in the present cases does not completely rule out a multifactorial origin, with a mixed contribution of mechanical (weakening of ligaments of the urinary bladder and/or pelvic connective tissues) and functional disorders.

Among the 5 reported cases (2 described previously and 3 in this report) with dynamic urethral kinking, 4 were Yorkshire terriers. This may be related to a selection bias due to the common occurrence of this breed in the referral populations. However, there may be a breed-predisposition of Yorkshire terriers to this atypical form of urethral obstruction. This could suggest higher prevalence of pelvic bladder in this breed or result from the high prevalence of concurrent conditions associated with increased abdominal pressure such as tracheal collapse, present in all dogs of this report. Further studies are necessary to confirm or rule out these hypotheses.

These cases illustrate the diagnostic value of manual voiding cysto-urethrography for the investigation of dynamic voiding disorders in dogs. A more systematic use of this technique may be useful to investigate dysuria associated with a pelvic bladder in dogs. Further investigations are required to rule out a possibly increased intrinsic cranio-caudal mobility of pelvic bladders, and possible predisposition to dynamic urethral obstruction in dogs with pelvic bladder.

Acknowledgments

The authors thank Drs. El Baze, Paul Benzimra, Sophie Bismuth, and David Benaim, who referred the cases to our facility and provided the follow-up care of the patients.

References


Prescribing patterns and comparison of culture versus empiric-based selection of meropenem in cats and dogs in a veterinary teaching hospital (2011–2018)

Lillian M. Cousto, J. Scott Weese, Shane W. Bateman

Abstract — The utilization of meropenem in a small animal veterinary teaching hospital over a 7-year period was retrospectively analyzed, and culture (CBD) versus empiric-based decisions (EBD) were compared. Meropenem was infrequently prescribed at a rate of 0.50 prescriptions/1000 admissions in cats and 0.58/1000 in dogs. The most common condition for meropenem prescription in both cats and dogs was septic peritonitis (15/52, 28.8%). Overall 65.4% of meropenem prescriptions were initiated without, or prior to, culture results indicating a need for the drug. Based on retrospective analysis of culture and susceptibility results, only 2.9% of empirical meropenem selections were indicated, while the majority were not indicated (52.9%), or of questionable indication (44.2%).

Résumé — Patrons d’ordonnance et comparaison de la culture versus le choix empirique de méropénème chez les chats et chiens dans un hôpital d’enseignement vétérinaire (2011-2018). L’utilisation de méropénème dans un hôpital d’enseignement vétérinaire pour animaux de compagnie durant une période de 7 ans fut analysée rétrospectivement, et la culture (CBD) versus la décision empirique (EBD) furent comparées. Le méropénème était prescrit peu fréquemment à une fréquence de 0,50 ordonnances/1000 admissions chez les chats et 0,58/1000 chez les chiens. La condition la plus fréquente pour la prescription de méropénème était la péritonite septique (15/52, 28,8 %). Globalement, 65,4 % des ordonnances de méropénème étaient initiés sans, ou précédeant, les résultats de culture indiquant un besoin pour ce médicament. Basé sur l’analyse rétrospective des résultats de culture et de sensibilité, dans seulement 2,9 % des cas le choix empirique de méropénème était indiqué alors que dans la majorité des cas (52,9 %), ce n’était pas indiqué ou c’était une indication discutable.

Introduction

The development of resistance to common antimicrobials and emergence of multi-drug resistant (MDR) bacteria have become important issues in human and veterinary healthcare alike. In recent years, an increased prevalence of companion animal infections resulting from MDR bacteria (1) has become concerning not only within the veterinary community, but public health concerns have been raised due to the risk of human transmission (2) and increased utilization of antimicrobials considered critically important for human medicine (3).

One such antimicrobial is meropenem, a carbapenem approved for human use with broad-spectrum activity against Gram-negative, Gram-positive, and anaerobic bacteria (4). As one of the limited options against certain resistant pathogens, particularly extended spectrum beta-lactamase (ESBL)-producing bacteria, the recent increased prevalence of these pathogens (5,6) has caused greater consideration for its utilization. Unfortunately, increased antimicrobial use is usually accompanied by greater selection pressure for bacterial resistance, and carbapenemase-producing bacteria, which have been associated with carbapenem resistance, have been identified in humans (7) and animals (8,9), highlighting the need for greater precautions to be taken to prevent the misuse of meropenem.

The American College of Veterinary Internal Medicine (ACVIM) has produced guidelines for antimicrobial use in animals to reduce the selection of resistant bacteria (10) and while antimicrobial utilization without confirmed infection is not recommended, there may be some situations in which drugs such as meropenem are used empirically. There have been limited studies on the empirical use of antimicrobials in veterinary medicine (11,12), and an important aspect of antimicrobial stewardship is monitoring drug use to establish benchmarks and identify potential areas for interventions. The objectives of this study were, therefore, to describe the prescribing patterns...
of meropenem in a referral veterinary hospital setting and evaluate the appropriateness of decision regarding empirical use.

**Materials and methods**

**Patient selection**

Pharmacy records at the Ontario Veterinary College Health Sciences Centre were searched to identify all prescriptions for meropenem in dogs and cats from June 1, 2011 to June 1, 2018. Computerized medical records were reviewed for the total number of canine and feline admissions and antimicrobial prescriptions over the same time period to compare overall meropenem prescription rates. Medical records of all cats and dogs prescribed meropenem over this time period were then searched for patient demographic variables and prescribing data.

**Meropenem prescribing**

Dose, dosing frequency, and duration of meropenem were recorded for each patient. Other antimicrobials prescribed before initiation, de-escalated to, or concurrently received during meropenem therapy were noted.

Meropenem selection was recorded as a culture-based decision (CBD) if bacterial culture results were available before treatment initiation identifying MDR bacteria that were susceptible to imipenem, the class agent used to assess for meropenem susceptibility. An empiric-based decision (EBD) was attributed if no culture was done or if culture results were not available before treatment initiation.

**Empirical-based decisions**

Referral letters and medical records were analyzed for reasons that explained the documented decision-making when empirical selection of meropenem without bacterial culture results occurred. Reasons were broadly categorized as: poor response to current antimicrobial therapy, other diagnostic test such as cytology or radiographs suggestive of worsening infection despite current antimicrobial therapy, pyrexia in the face of current antimicrobial therapy, concern for MDR bacteria, severity of illness, owner-related factors, or no indication specified in record.

In order to determine whether the decision for meropenem selection was indicated or not, a series of criteria was used (Figure 1). For EBD, meropenem was considered indicated if there was a culture and susceptibility panel pending at the time of decision or performed after the decision (including post-mortem) that indicated the presence of bacteria susceptible to

![Flowchart of criteria for meropenem indication](image-url)
imipenem but resistant or of known inherent resistance to other available antimicrobials considered unreserved, or susceptible to unreserved options considered contraindicated (such as aminoglycosides in a patient with renal compromise).

Unreserved antimicrobials were considered those that could be used as first or second line therapeutic choices as per previously published guidelines at this hospital (13) and included penicillins (ampicillin, amoxicillin, penicillin G), potentiated penicillins (amoxicillin-clavulanic acid), first, second, and third-generation cephalosporins (cefazolin, cephalexin, cefoxitin, ceftriaxone), trimethoprim-sulfonamides, tetracyclines (doxycycline), metronidazole, macrolides (erythromycin, tyllosin), minocycline, or fluoroquinolones. If culture results indicated a bacterial infection that was susceptible to unreserved antimicrobials with no contraindications or was resistant to imipenem (and thereby inferred to be resistant to meropenem), the decision was considered not indicated. If no culture was performed or there was no bacterial growth on the culture, meropenem indication was considered unknown.

**Illness severity, hospitalization, and mortality**

Severity of illness was recorded using APPLEx scoring (14,15) and was calculated from information obtained within 24 h of admission. Not all values required for APPLEx scoring were available for all patients, and those with incomplete data were excluded from this evaluation. Length of hospitalization and outcome of the hospital visit (patient was discharged from hospital, died, or was euthanized) were also recorded.

**Data analysis**

Patient variables were recorded in a computerized spreadsheet (Microsoft Excel; Microsoft, Redmond, Washington, USA) and statistical software (SAS/STAT Version 9.4; SAS Institute, Cary, North Carolina, USA) was used for statistical analysis. The Shapiro-Wilk test was used to determine normality of continuous data, which are presented as means or medians. Categorical data are presented as percentages. A Student’s t-test was used to compare parametric data and a Fisher’s exact test was used for non-parametric data. A P-value ≤ 0.05 was considered statistically significant.

**Results**

**Patient population**

Overall, meropenem was prescribed to 52 small animal patients, including 5 cats and 47 dogs out of a total of 1525 feline (0.33%) and 9968 canine (0.47%) patients prescribed antimicrobials over the June 1, 2011 to June 1, 2018 time period. There were 10 042 feline and 81 047 canine admissions to the OVC Companion Animal Hospital during this time period, making the prescription rate per 1000 admissions, 50 for cats and 0.58 for dogs. Patient characteristics are presented in Table 1.

**Prescribing patterns**

Meropenem was prescribed for various conditions in cats and dogs (Figures 2, 3). Septic peritonitis was the most commonly prescribed condition for both cats and dogs (15/52, 28.8%). Most patients (47/52, 90.38%) had comorbidities indicated in the record.

**Meropenem selection**

Empirc-based decisions to select meropenem were more common (34/52, 65.4%) than culture-based decisions (18/52, 34.6%) in this patient population. In the EBD group, reasons for use of meropenem were found in the records of 27 of 34 (79.4%) patients. Seven patients (20.6%) within the EBD group had no reason indicated for selection of meropenem while several patients had more than one factor listed in the medical records. The underlying reasons to select meropenem were grouped into categories including: patient deterioration or inadequate response despite current antimicrobial therapy (n = 17), diagnostic test result suggestive of worsening infection while on current antimicrobial therapy (n = 8), pyrexia in the face of ongoing antimicrobial therapy (n = 7), concern for MDR bacteria (n = 5), and severity of illness (n = 4). In 1 case, the medical record indicated meropenem selection was based on owner preference for a single broad-spectrum antimicrobial rather than administering multiple unreserved antimicrobials and this was considered client/owner-based factor. The frequency that each reason was listed amongst total records that had reasons listed (n = 27) is shown in Figure 4.

**Bacterial culture**

Culture and susceptibility test results were available for all (18/18) of the CBD group. Imipenem was used as the class agent to test for meropenem susceptibility on the extended...
spectrum bacterial susceptibility panel. When culture results were used to select meropenem, MDR Enterobacter cloacae (8/18, 44.4%), Enterobacter spp. (2/18, 11.1%), and Escherichia coli (8/18, 44.4%) were most commonly involved, all MDR bacteria susceptible to imipenem yet resistant to unreserved antimicrobials, indicating appropriate selection of the drug. In 7 of 18 cases (38.8%), however, a second bacterial pathogen was grown when the choice of meropenem was questionable, because of the availability of other potential unreserved treatment options or debatable relevance of the initial bacterial isolate. These consisted of Enterococcus spp. (4/18, 22.2%), Pasteurella canis (1/18, 5.6%), Clostridium perfringens (1/18, 5.6%), and Actinomyces spp. (1/18, 5.6%).

Culture results were available for 31 of 34 (91.2%) cases in the EBD group. Susceptibility results were not available for 1 patient, from which Klebsiella spp. was isolated post-mortem. Isolated pathogens for which susceptibility data were available included: streptococci (S. agalactiae, S. canis, Streptococcus spp.), Pasteurella dagmatis, Pseudomonas aeruginosa, Bacteroides spp., Staphylococcus pseudintermedius (including 1 culture resistant to meropenem), E. coli, Enterococcus spp., E. cloacae, and C. perfringens.

Meropenem indication based on culture results is displayed in Figure 5. Fifty-three percent (18/34) of the EBD group were not indicated including 17 (50%) that were susceptible to meropenem but also to an unreserved antimicrobial and 1 case (2.9%) in which meropenem was contraindicated as the dog was infected with methicillin-resistant Staphylococcus pseudintermedius (MRSP), a bacterium that is resistant to carbapenems. Unknown indication occurred in 15 (44.1%) cases including 11 (32.4%) with no growth on culture results, 3 (8.8%) that had no culture done, and 1 (2.9%) with culture results but no susceptibility results available, precluding an ability to conclude that meropenem was indicated. Overall, meropenem was only clearly indicated in 1 case (1/34, 2.9%), a patient with ESBL E. coli aspiration pneumonia.

Mortality, severity of illness

Patients prescribed meropenem had high overall illness severity scores and mortality rates regardless of culture- or empirical-based antimicrobial decision-making; however, these values were higher within the EBD group (Figure 6). Overall mortality among all patients prescribed meropenem was 51.9% (27/52), including 19 of 27 (70.4%) that were euthanized in hospital, 6 of 27 (22.6%) that died in hospital, and 2 of 27 (7.4%) that were discharged for the purpose of euthanasia at home. Mortality was higher in the EBD group (24/34, 70.6%) than the CBD group (3/18, 16.7%), \( P < 0.001 \).

Complete data were available to calculate APPLEx fast scores for 45 of 52 (86.5%) patients. Empiric-based decision patients had higher mean APPLEx fast scores than the CBD group (Figure 6), 26.7 versus 21.2, respectively \( P = 0.004 \). Mean days of hospitalization were higher in the CBD (9.6 d) versus the EBD (4.3 d) patients \( P = 0.001 \). There was no significant difference of mean rectal temperature between the EBD (38.8°C) and CBD (38.4°C) groups \( P = 1.0 \).

Meropenem dosing, concurrent antimicrobial use, and de-escalation

The majority of patients (49/52, 94.2%) were receiving other antimicrobial therapy in the time period immediately before initiation of treatment with meropenem. Doses and dose ranges varied over this time period from 7 to 25 mg/kg body weight (BW) every 8 to 24 h with a median dose and frequency of 8.5 mg/kg BW every 8 h. Most patients (28/52, 53.8%) did not receive other antimicrobials during meropenem therapy. Of the 14 of 52 (26.9%) patients that received other antimicrobials concurrently with meropenem, 13 of 14 (92.9%) were continued on their previously prescribed antimicrobials without de-escalation. Only 1 (1/14, 7.1%) patient was prescribed an additional antimicrobial (amikacin) while receiving meropenem, a cat with MDR E. cloacae urinary tract infection.

De-escalation from meropenem to a more targeted antimicrobial occurred in 90% (9/10) of surviving patients from the EBD group and 46.7% (7/15) of surviving patients from the CBD group. No de-escalation was evident in the non-survivors and they either died or were euthanized while still receiving meropenem. Drugs chosen for de-escalation in the CBD group included amoxicillin-clavulanic acid \( (n = 3) \), cephalodoxime \( (n = 1) \), marbofloxacin \( (n = 1) \), minocycline \( (n = 1) \), and trimethoprim sulphamethoxazole \( (n = 1) \). De-escalation in
Meropenem prescription occurred infrequently in this tertiary care patient population, with rates of 0.50 for cats and 0.58 for dogs per 1000 admissions. This was unchanged from the 0.50 carbapenem prescriptions per 1000 small animal admissions previously reported at this hospital in 2004, a rate which had significantly decreased from 1.3 in 1995 after antimicrobial guidelines had been implemented (13). Though the persistently low utilization rate supports that these guidelines have remained effective in discouraging antimicrobial misuse, they remain only recommendations. Other than vancomycin, there are no formal antimicrobial prescribing restrictions at this hospital including for meropenem, which may explain why the prescription rate had not decreased further. In contrast to the low rates at this and other veterinary hospitals (12), meropenem is used more frequently in humans, with prescription rates almost 50-fold higher in some hospitals (16), highlighting the importance of this drug in human healthcare.

While the overall prevalence of meropenem prescriptions was low, most meropenem use (65.4%) was not guided by cultures indicating a need for the drug, similar to empirical meropenem prescription rates (67.2%) in some human reports (17). Empirical therapy is not uncommon in animals (12) and can be an appropriate and effective tool; however, understanding the reasons for empirical selection is important to optimize antimicrobial-use practices. In our study, mortality and APPELfast illness severity scores were both significantly higher in the EBD group; yet only 4 (11.7%) patient records implicitly stated that the EBD was due to severity of illness. The other common reasons for EBD, including poor response to current antimicrobial therapy (50%), other diagnostic tests suggestive of worsening infection (23.5%), and pyrexia (20.6%), may have indirectly suggested severely ill patients. However, these reasons alone are not strong arguments for empirical selection, as they are non-specific to the development of an MDR pathogen and may be the result of other disease factors or non-bacterial causes. The main indication for empirical meropenem prescription amongst our veterinary population would be treatment of suspected resistant infections, such as ESBL-producing Enterobacteriaceae. Yet only 5 EBD patient records explicitly stated a concern for MDR bacteria, and while ESBL-producing bacteria can cause challenging resistant infections in animals (18), there was only 1 incidence of infection by an ESBL-producing bacterium amongst this group.

There may be a tendency to reach for advanced antimicrobials like meropenem in patients with serious infections, out of fear of missing an opportunity to intervene rather than because of evidence that it was truly indicated. Early antimicrobial prescription has been associated with decreased mortality rates in severe sepsis and septic shock in humans (19) and the Surviving Sepsis Guidelines recommend initiation of broad-spectrum empiric therapy within an hour of presentation in septic patients (20).
However, in veterinary studies, no significant difference in mortality has been found between dogs with septic peritonitis that received antimicrobials within 6 h versus 1 h of presentation (21), or in dogs with pneumonia (22) or septic peritonitis (23) empirically prescribed appropriate versus inappropriate antimicrobial therapy. Although retrospective in nature, it has been speculated that the delay in appropriate antimicrobial therapy for 36 to 48 h, while awaiting culture results, would have little effect on mortality except in septic shock patients (24) and further studies are warranted as the majority of veterinary patients may not need advanced empirical therapy such as meropenem.

Only a small percentage (2.9%) of EBDs were indicated to use meropenem based on retrospective analysis, while most had either unknown indication (44.1%) or were not indicated (52.9%). In comparison, a retrospective analysis of empiric carbapenem prescriptions in humans found 21% of selections were appropriate, with 42% being suboptimal, and only 37% being inappropriate (25), demonstrating that although there is better empirical carbapenem selection in humans, the need for improved prescribing guidelines in human and veterinary medicine still exists.

Empirical meropenem selection can be a reasonable approach in some cases; however, rarely, is it required for the duration of treatment and de-escalation or transitioning from broad-spectrum empiric therapy to more targeted drugs once the causative pathogen is identified, is an important antimicrobial stewardship practice. In humans with severe sepsis and septic shock, de-escalation has been shown to improve patient outcome (26) and in meropenem-specific de-escalation programs, decreased overall use (27), and mortality (28). In our study, de-escalation of meropenem was evidenced in most of the surviving patient population and was higher in the EBD group (90%) than the CBD group (46.67%), indicating that clinicians were effectively using de-escalation practices once culture results revealed an absence of indication for meropenem. The relatively high rate of de-escalation was encouraging; yet it also highlights the lack of need for meropenem as an empirical choice in most cases.

Finally, a major concern with empirical meropenem prescribing in animals is that the appropriate meropenem dose for veterinary patients is not currently known, which may explain the wide range of doses and frequencies observed amongst our population over the time period sampled. Initial studies suggested doses of 8 mg/kg BW, IV every 8 to 24 h in dogs (4), yet more recent reports have advised higher doses up to 24 mg/kg BW every 8 to 12 h (29). Specific breakthroughs for meropenem have also yet to be established in animals (30) and the drug concentrations at which bacteria are susceptible to meropenem remain undetermined, with most pharmacokinetic studies of meropenem in animals using breakpoints from human data (31). Additional studies are necessary to determine the optimal meropenem dose in veterinary patients and until identified, the true effectiveness of this drug remains questionable, furthering concerns for its empiric use.

Being retrospective in nature, this study is limited by the comprehensiveness of the medical records stating the reasoning for empirical meropenem selection and observational bias of meropenem indication based on the culture and susceptibility results available. Meropenem-prescribed patients were not compared with patients that received other antimicrobials empirically. These results may apply only to our hospital where meropenem is used infrequently; further studies involving multiple facilities would be more representiative of the entire companion animal population. A questionnaire to prescribing clinicians, asking them to confirm their reasons for empirical meropenem selection was not included in this study and the actual prescribing influences remain unknown.

While meropenem utilization was low in our hospital, the majority of empirical prescriptions were not justified, and with the emergence of carbapenemase-producing bacteria, judicious empirical selection of meropenem is indicated. In some human hospitals, guidelines have been developed and empiric meropenem use has been restricted to include cases of suspected severe sepsis or where increased risk factors for bacterial resistance exist (17). Though resistance has been rare thus far, in veterinary medicine, similar guidelines and de-escalation strategies for meropenem in animals may be beneficial in order to reduce empirical prescription and promote better overall use of this clinically important drug.

Acknowledgments

The authors acknowledge Elizabeth Reemeyer from the Information Technology Service at the Ontario Veterinary College, for her contribution with medical record collection and Gabrielle Monteith, Department of Clinical Studies, Ontario Veterinary College, for assistance with data analysis.

References

Clinical findings, diagnoses, and outcomes of horses presented for colic to a referral hospital in Atlantic Canada (2000–2015)

Jaclyn M. Kaufman, Omid Nekouei, Aimie J. Doyle, Nora M. Biermann

Abstract — Medical records of equine patients presented for signs of abdominal pain to the Atlantic Veterinary College Teaching Hospital between 2000 and 2015 were reviewed. A total of 575 patients were enrolled, and the most common clinical findings, diagnoses, and outcomes are described. Potential predictors of survival to discharge were assessed. The most common diagnosis was large colon impaction (18.4%), followed by large colon volvulus (6.2%). Overall survival to discharge was 69%. The survival rates for horses were 82.9% for those with no diagnosis, 74.6% for those with large intestine lesions, and 38.5% for those with small intestine lesions. Significant predictors for non-survival were increasing age, increasing duration of colic signs, severity of colic, and a lesion in the small intestine. These data are important for veterinarians in the region who are treating cases of equine colic and advising clients.

Résumé — Trouvailles cliniques, diagnostics et issues de chevaux présentés pour colique à un centre de référence dans les provinces atlantiques canadiennes (2000-2015). Les dossiers médicaux de patients équins présentés pour des signes de douleur abdominale à l’hôpital d’enseignement vétérinaire du Atlantic Veterinary College entre 2000 et 2015 ont été revus. Un total de 575 patients furent recrutés, et les trouvailles cliniques, diagnostics et issues les plus fréquents sont décrits. Les prédicteurs potentiels de survie jusqu’au congé sont évalués. Le diagnostic le plus fréquent était l’impaction du côlon (18,4 %), suivi du volvulus du côlon (6,2 %). La survie globale jusqu’au congé était de 69 %. Les taux de survie pour les chevaux étaient de 82,9 % pour ceux sans diagnostic, 74,6 % pour ceux avec des lésions au gros intestin et de 38,5 % pour ceux avec des lésions au petit intestin. Les prédicteurs significatifs pour la non-survie étaient une augmentation de l’âge, une augmentation de la durée des signes cliniques, la sévérité des coliques et une lésion au petit intestin. Ces données sont importantes pour les vétérinaires en région qui traitent les cas de coliques équines et conseillent les clients.


Introduction

Colic is the generalized term for visceral abdominal pain and acute abdominal disease and is a common cause of morbidity and mortality in horses (1,2). Colic is most commonly related to gastrointestinal disorders in horses, including gastrointestinal obstruction, strangulation, infarction, enteritis, ulceration, and ileus (1,3). Some diseases of other organ systems, such as urinary obstruction or uterine torsion, produce similar signs of acute abdominal discomfort (2). Depending on the underlying problem, treatment and prognosis can vary significantly (1,3).

There are several reports on predictors for the outcome of equine colic (3–8). Physical examination findings and diagnostic tests have been identified as indicators in some studies (7,9) and horse signalment may present risk factors for specific types of colic (6,10). These results are not always consistent among studies and differences in horse populations and geographic locations may explain some of these inconsistencies (11,12). The prevalence of specific colic disorders and prognosis can vary with the geographical region (11,12). For example, large colon sand impactions are common in certain regions with loose sandy soil, such as the southwestern United States (13) and the prognosis after surgical correction of large colon volvulus varies widely among studies in different regions (14,15).

With the often sudden onset of typical clinical signs, both owner and referring veterinarian are faced with deciding whether
the horse can be treated on-farm or requires more intensive care in a referral hospital. This may become a challenge in rural areas like Atlantic Canada, where only 1 veterinary hospital with surgical facilities for horses services the 4 provinces. Travel times can be long (sometimes more than 12 h) and can be hazardous especially in winter weather conditions. Knowledge of the most common disorders in the region of practice, in addition to prognosis and mortality rates, is beneficial to equine veterinarians when advising horse owners on cases of equine colic (11).

While Abutarbush et al (10) reported the most common causes and survival rates of referral cases in western Canada, this may not represent cases of colic across Canada. Currently there are no publications that report the clinical signs, diagnoses, treatment, and prognosis of colic occurring in Atlantic Canada.

The objective of this study was to describe the clinical findings, diagnosis, treatment, and outcome of horses presented for colic to a referral hospital in Atlantic Canada. A secondary objective was to determine factors associated with survival to discharge from the hospital in this population of horses.

**Materials and methods**

Medical records of horses presented with signs of abdominal pain to the Atlantic Veterinary College Veterinary Teaching Hospital, between January 2000 and December 2015, were reviewed. Cases were excluded from the study population if the horse arrived with clinical signs other than abdominal discomfort and/or a colic work-up was not performed.

Data collected from the medical records included: patient signalment (age, breed, gender, and weight), the severity of colic signs upon presentation (mild, moderate, or severe), diagnosis based on initial work-up, type of treatment (euthanasia after initial work-up, medical or surgical treatment), surgical or necropsy findings, duration of hospitalization (in days), if a referring veterinarian had examined the horse, and the duration of colic signs before presentation (in hours). Recorded physical examination findings upon admission included mentation (bright and alert, quiet, depressed, agitated/painful), rectal temperature (°C), heart rate (beats/min), respiratory rate (breaths/min), capillary refill time (in seconds), mucus membrane color (pink, hyperemic, toxic line present, cyanotic, or icteric), estimated level of dehydration, and gastrointestinal sounds (normal, decreased, absent). The estimated level of dehydration was categorized as: normal to ≤ 5%, 6% to 8%, ≥ 9% dehydration. Findings of additional diagnostic tests were recorded when performed, including nasogastric intubation, rectal examination, abdominal ultrasound, and abdominocentesis. When performed, total protein (g/L) and L-lactate (mmol/L) concentrations of the abdominal fluid were recorded, as well as results of blood analysis upon admission, including complete blood (cell) count (CBC), total neutrophil count, presence of band neutrophils and toxic changes (%), total protein (g/L), hematocrit (L/L), blood glucose (mmol/L), and L-lactate (mmol/L). Based on the medical records, the outcomes of study cases were categorized as: i) survival to discharge, ii) dead upon presentation, iii) euthanized during surgery, iv) euthanized during recovery from anesthesia, v) euthanized due to unsuccessful management of colic, or vi) euthanized due to complications of colic or treatment.

**Table 1. Frequency distribution of physical examination findings in 575 horses presented for colic signs to the Atlantic Veterinary College between 2000 and 2015.**

<table>
<thead>
<tr>
<th>Physical examination parameters</th>
<th>Categories</th>
<th>Number of cases/number recorded</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentation</td>
<td>Bright and alert</td>
<td>218/536</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>Quiet</td>
<td>132/536</td>
<td>24.6</td>
</tr>
<tr>
<td></td>
<td>Depressed</td>
<td>120/536</td>
<td>22.4</td>
</tr>
<tr>
<td></td>
<td>Agitated/Painful</td>
<td>66/536</td>
<td>12.3</td>
</tr>
<tr>
<td>Gastrointestinal sounds</td>
<td>Normal</td>
<td>90/487</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>258/487</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td>81/487</td>
<td>16.6</td>
</tr>
<tr>
<td></td>
<td>Hypermotile</td>
<td>58/487</td>
<td>11.9</td>
</tr>
<tr>
<td>Mucous membranes</td>
<td>Pink</td>
<td>341/496</td>
<td>68.8</td>
</tr>
<tr>
<td></td>
<td>Hyperemic</td>
<td>63/496</td>
<td>12.7</td>
</tr>
<tr>
<td></td>
<td>Pale</td>
<td>51/496</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td>Cyanosis/gray</td>
<td>10/496</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Icteric</td>
<td>7/496</td>
<td>1.4</td>
</tr>
<tr>
<td>Capillary refill time</td>
<td>&lt; 2 s</td>
<td>170/545</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td>2 s</td>
<td>182/545</td>
<td>33.4</td>
</tr>
<tr>
<td></td>
<td>&gt; 2 s</td>
<td>193/545</td>
<td>35.4</td>
</tr>
<tr>
<td>Hydration status</td>
<td>Normal</td>
<td>79/319</td>
<td>24.8</td>
</tr>
<tr>
<td></td>
<td>≤ 5% dehydrated</td>
<td>122/319</td>
<td>38.2</td>
</tr>
<tr>
<td></td>
<td>6% to 8% dehydrated</td>
<td>86/319</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>≥ 9% dehydrated</td>
<td>32/319</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**Statistical analysis**

All statistical analyses were carried out using Stata v15.1 (StataCorp, College Station, Texas, USA). Overall, 575 horses with colic signs were included in our study. Frequency distributions of all collected data: e.g., horses signalment, physical examination findings upon admission, laboratory results, diagnoses, treatments and outcomes of study cases were described and/or tabulated. For continuous variables, median/mean and interquartile range (IQR), and for categorical variables, number of samples within each category (%) were presented. For further analyses, the outcomes of study cases were dichotomized as “survival” and “non-survival” because of the low number of cases in some of the outcome categories. Horses that were not treated but either arrived dead or were euthanized after initial physical examination were excluded from the remainder of the analysis. Therefore, a total of 502 horses were used in further analyses (i.e., regression models).

Simple logistic regression models were applied to evaluate the potential univariable associations between each independent variable of interest (including signalment of the horse, physical examination findings, laboratory parameters, treatments, and diagnosis based on anatomic location of the lesion) and survival to discharge of enrolled cases (the dependent variable of interest). To assess the most important predictors of non-survival, a multivariable logistic regression model was built, including select independent variables with $P < 0.2$ from the univariable analyses. Selection of variables was also based on: i) low number of missing values, ii) collinearity/interrelation between these variables, and iii) minimizing bias introduced by factors such as financial constraints of the owners, which are difficult to assess retrospectively. Variables which were initially included
in the multivariable logistic regression model were age, weight, duration of colic signs prior to admission, severity of colic signs upon admission, medical versus surgical treatment, and diagnosis by location in the gastrointestinal tract. A backward elimination strategy was applied and variables with \( P \leq 0.05 \) were retained in the model. All 2 \( \times \) 2 interactions between the independent variables were evaluated in the model. Model fit and diagnostics for the final model were assessed. The results of uni- and multi-variable logistic regression models were presented as odds ratios (ORs), along with their respective 95% confidence intervals (CIs).

## Results

A total of 575 horses were presented for signs of abdominal discomfort to the Atlantic Veterinary College during the study period and underwent a diagnostic work-up for colic. Median age and weight of horses upon presentation were 7.7 y (IQR: 3.3 to 13.2 y) and 480 kg (IQR: 335 to 625 kg), respectively.

Of the 575 study horses, the most common breeds were Standardbred (28.8%), Quarter horse (15.5%), Thoroughbred (9.8%), Warmblood (9.8%), draft horse breeds (8.7%), and mixed breeds (7.5%) which were consistent with the overall hospital population. The remaining 19.9% of horses consisted of a large variety of other breeds. Mares accounted for 47.9% of cases, geldings 36.9%, and stallions 15.2%. Sixty-six percent of horses were admitted during emergency hours and 89% of horses were first seen by a referring veterinarian with a median duration of colic signs upon admission of 16 h (IQR: 1 to 240 h).

A diagnostic work-up was performed on all cases; however, the same procedures and diagnostic findings were either not performed or not recorded in every case. In the following sections, totals represent the number of cases in which the variable or procedure was recorded in the patient file.

### Findings of initial colic examination

The severity of colic signs upon admission ranged from none or mild in 44.1% (230/522), moderate in 33.3% (174/522), and severe in 22.6% (118/522) of cases. Median heart rate recorded upon admission was 54 beats/min (IQR: 24 to 160 beats/min), median respiratory rate was 20 breaths/min (IQR: 8 to 84 breaths/min) and median rectal temperature was 37.9°C (IQR: 35.0°C to 40.4°C). Additional physical examination findings upon admission to the hospital are presented in Table 1.

Upon admission, a nasogastric tube was placed in 70.8% (395/558) of cases, and net reflux was recorded in 14.5% (81/558) while no reflux was recorded in 56.3% of horses (314/558). A rectal examination was performed in 87.2% of cases (485/556), with “no significant findings” being the most common result (30.7% of the examinations; 149/485), followed by “large colon impaction” (23.7%; 114/485), and “large gas distended viscus” (23.1%; 112/485). In 60.1% (331/551) of cases, an abdominocentesis was attempted and abdominal fluid was obtained in 77.9% of the attempts (258/331), with gross abnormalities detected in 32.2% of cases (83/258). Signs consistent with enterocentesis were observed in 3.9% of these cases (10/258). Abdominal ultrasound examination was infrequently performed before 2005 at this hospital, but later became a common diagnostic tool which was used in 47.6% of recorded cases. In most cases, no abnormalities were reported (147/258), followed by “distended small intestine” (36/258), and “increased abdominal fluid” (18/265). Table 2 shows laboratory parameters upon admission for survivors and non-survivors.

### Diagnosis

The most frequent diagnosis in this population of horses (N = 575) was large colon impaction (18.4%), followed by large colon volvulus (6.2%), and right dorsal displacement of the large colon (5.7%) (Table 3). Of all cases admitted for colic signs, 21.2% were undiagnosed. Overall, 50.4% of cases were diagnosed with a lesion in the large intestine while 20.3% of cases had a lesion in the small intestine. Lesions in other areas of the gastrointestinal tract were found in 3.8% of cases and 3.3% of those presented for colic had lesions unrelated to the gastrointestinal tract. Due to the small numbers in each category, the latter 2 categories were excluded from the uni- and multi-variable analyses.

Cases in which no diagnosis was recorded had the highest rate of survival to discharge (82.9%) followed by large intestine related cases (74.3%) and small intestine cases (35.8%). Overall, 19.7% of horses diagnosed with a lesion in the small intestine were euthanized without further treatment as compared to 7.3% of horses diagnosed with a lesion in the large intestine and 10% of horses with no diagnoses.
### Table 3. Frequency distribution of the most common diagnoses of horses presented for colic signs to the Atlantic Veterinary College between 2000 and 2015.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open&lt;sup&gt;a&lt;/sup&gt;</td>
<td>122 (21.2)</td>
</tr>
<tr>
<td>Large colon impaction</td>
<td>106 (18.4)</td>
</tr>
<tr>
<td>Large colon volvulus</td>
<td>36 (6.3)</td>
</tr>
<tr>
<td>Right dorsal displacement of the colon</td>
<td>53 (5.7)</td>
</tr>
<tr>
<td>Spasmodic colic</td>
<td>25 (4.3)</td>
</tr>
<tr>
<td>Colitis</td>
<td>23 (4.0)</td>
</tr>
<tr>
<td>Scrotal/inguinal hernia</td>
<td>22 (3.8)</td>
</tr>
<tr>
<td>Left dorsal displacement of the colon</td>
<td>18 (3.1)</td>
</tr>
<tr>
<td>Gastric ulcer</td>
<td>18 (3.1)</td>
</tr>
<tr>
<td>Strangulating lipoma</td>
<td>17 (3.0)</td>
</tr>
<tr>
<td>Others&lt;sup&gt;b&lt;/sup&gt;</td>
<td>155 (27.0)</td>
</tr>
<tr>
<td>Total</td>
<td>575 (100)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Open diagnoses included all cases in which no definitive diagnosis was stated in the medical records.

<sup>b</sup> Others included a variety of other gastrointestinal lesions (n = 136/575, 23.6%) and a small number of lesions not associated with the gastrointestinal tract, i.e., uterine torsion, cholangiohepatitis (n = 19/575, 3.3%).

### Treatment and univariable association of variables with outcome

The overall survival rate was 68.9%. Figure 1 shows horses presented for signs of colic by their outcome (survival versus non-survival) and type of treatment (medical versus surgical). Horses were treated medically in 59.3% of cases and 86.5% survived to discharge, while 28.0% of horses underwent surgical treatment and 62.7% survived to discharge. This resulted in greater odds not to survive to discharge in surgically treated horses based on univariable association (P < 0.001; Table 4). However, of all surgical cases, 23.0% (37/161) of the horses were euthanized during surgery, and of horses that survived recovery from surgery and anesthesia, 83.4% (101/121) survived to discharge.

Physical examination parameters upon admission and their univariable association with the outcome are presented in Table 4. Increases in both heart rate (P < 0.001) and respiratory rate (P = 0.007) were significantly associated with higher odds of non-survival to discharge. Other physical examination findings associated with increased odds of non-survival in the univariable analyses were the absence of gastrointestinal sounds (P < 0.001) and changes in mentation, from bright and alert or quiet to either agitated or depressed (P < 0.001; Table 4).

Several laboratory parameters measured at the time of initial admission were found to be significantly associated with outcome (Table 4). Increases in hematocrit (P < 0.001), fibrinogen (P = 0.009), blood glucose (P < 0.001) and L-lactate in blood (P < 0.001) and abdominal fluid (P = 0.003), as well as total protein in abdominal fluid (P = 0.010) were significantly associated with increased odds of non-survival to hospital discharge (Table 4).

### Multivariable association of variables with outcome

Cases with a clinical diagnosis that supported a lesion located in either the large or small intestines had significantly higher odds of “non-survival” compared with cases that had no diagnosis (P < 0.001; Table 5).

Strong collinearity was observed between “severity of colic signs” and “medical versus surgical treatment;” i.e., more horses with more severe signs underwent surgical treatment. Therefore, “severity of colic signs” was chosen to be included in the final model which showed that horses with more severe signs of colic were less likely to survive (“medical versus surgical treatment” acted as an intervening variable) (P < 0.001; Table 5).

Similarly, increases in horses’ age and weight were positively associated with non-survival based on univariable analysis, but collinearity was observed between these variables with older horses weighing more than younger horses. Horse’s age was maintained in the final model since it was recorded for more horses and had a stronger positive association with non-survival (P = 0.031) (Table 5).

Duration of colic signs upon admission was significantly associated with survival (P = 0.012); horses displaying colic signs for more than 12 h and less than 36 h were more likely not to survive to discharge than horses with less than 12 h or more than 36 h (Table 5).

### Discussion

Our study described the population of horses presented for colic signs to the Atlantic Veterinary College over the course of 16 y and identified several factors associated with survival to discharge in this population. Although we collected a vast number of variables and found many of those independently associated with “survival to discharge,” the main challenge was to determine the relationships among these independent variables and how they may drive the outcome of interest (i.e., a theoretical web of causation). Therefore, we decided to focus on the variables that were believed to act as the underlying causes of colic and were unaffected by findings of the initial physical examinations. Vital parameters and laboratory findings are considered the consequences of case-history variables (e.g., age, the duration of colic signs, intestinal location affected, treatments) and theoretically acted as intervening variables in the association between these variables and “non-survival.” As such, they were not included in the multivariable modeling. As expected, there were strong correlations among the majority of vital and laboratory parameters. For instance, there was a strong correlation between abdominal and blood L-lactate and ischemic/strangulating intestinal lesion, and they were in turn strongly associated with the severity of the lesions causing colic. Our approach also attempted to reduce the influence of bias factors like owners’ financial constraints and clinicians’ perception of chances of survival based on clinical signs.

“Diagnosis by location of the lesion” was used in the multivariable modeling because it was perceived as useful information for a practitioner in the field who may have a suspicion of where the lesion is located. Therefore, our final model included horse’s age, duration of colic signs on admission, severity of colic signs on admission, as well as diagnosis.

Median age of horses presenting for colic is similar across studies, showing a wide age range inclusive of the full lifespan of the horse (10–12). Similarly, some studies have found increasing age increases the risk of non-survival (8,12,14,16) while others did not find a difference in outcome when comparing geriatric...
horses versus adult horses (17). Geriatric horses were more likely to sustain small intestine strangulating lesions (17,18). Although this did not necessarily affect chances of survival in this group of horses (17), small intestine lesions have been repeatedly found to carry lower chances of survival than other gastrointestinal lesions, regardless of medical or surgical treatment (3,4,9–12,19,20) which is also supported by our results. It is possible that owners are less likely to treat or perform surgery on older horses, worsening the outcome for this age group; however, it was not possible to determine owner perceptions and decision-making retrospectively. Co-morbidities accompanying horses of advanced age may also play a role in both decreasing their survival and affecting the decision to continue treatment.

A Danish study similarly reported that the short-term survival rate of horses with large intestine colic lesions was improved compared to those with small intestine lesions, with 78% of horses with large intestine colic surviving to discharge and 34% of those with small intestine colic surviving to discharge (11). These authors speculated that it might be related to owner's reluctance to elect surgery when a poor prognosis was given in such cases, but this is difficult to determine retrospectively (11). Data on the types of colic associated with euthanasia before treatment are lacking, but in the present study 19.7% of all horses with small intestine colic presenting to our hospital were euthanized after initial diagnostic workup, compared to only 7.3% of those with large intestine colic. This may, in part, explain the differences in overall survival rates between horses with these 2 types of colic, as there appears to be a difference in whether the client elected to continue treatment. The reasons why owners elected euthanasia could not be determined, but it is known that small intestine causes of colic have a higher estimated cost, increased risk of complications, and more frequent need for intensive postoperative care. In addition, success rates after surgical treatment of small intestine lesions tends to be lower than that with large intestine surgery (7,9,19,21–23). It is speculated that these added risks and costs are the reason that a larger proportion of horses with small intestine colic were euthanized after initial diagnostics. Van der Linden et al (3) reported 8.3% (54/649) of horses with colic were euthanized upon arrival, which consisted of 31 cases of poor prognosis and 23 cases due to economics (3). There are often multiple factors involved in client's decisions, such as finances, prognosis, animal welfare, and personal beliefs. A prospective study would be required to quantify these differences.

Increasing severity of colic signs and pain as risk factors for short-term mortality have been reported in other studies (3,5,7,24). The severity of clinical signs or pain is often not reported, potentially because it is a subjective measure that is variably recorded in medical records. Our results confirm what is clinically expected by veterinarians, that severe and worsening clinical signs of colic and pain increase the risk of non-survival. One report refuted this, with results that increased mortality was shown with less signs of colic, with the suspicion that this was due to devitalized bowel or delay of surgery due to lesser signs of colic (14). However, our study shows that odds of non-survival to hospital discharge are nearly 10 times higher when the horse experiences severe signs of colic upon admission. Interestingly, medical versus surgical treatment was significantly associated with chances of survival in the univariable analysis but when severity of colic signs and type of treatment were included in the multivariable model the type of treatment became non-significant. Also, improved odds of survival with medical versus surgical treatment have been reported previously (3,4,11) and these findings may indicate that horses that showed more severe signs of colic were more likely to undergo surgical intervention. This is logical since one of the major indications to pursue colic surgery is the horse's unresponsiveness to pain control, which is more likely when the horse is already displaying painful behavior.

Figure 1. Horses (N = 575) presented for colic signs to the Atlantic Veterinary College between 2000 and 2015 by their outcome (survival versus non-survival) and treatment (surgical versus medical).
upon admission. While severity of colic signs was maintained in the final model the type of treatment was removed due to this indication of strong confounding between these 2 variables.

In our study, increased duration of colic signs before admission to a referral institution was associated with higher odds of non-survival to discharge, which has also been reported by others (3,10). However, the odds for non-survival were higher for horses presenting with colic of 12 to 36 h duration compared with >36 h. This was also found by van der Linden et al (3) who found a greater risk for colic duration of 6 to 12 h compared to 12 to 24 h. This is presumed to be related to the severity and type of colic, with horses with severe signs of colic (such as strangulating lesions requiring surgery) likely being referred faster than those with milder signs of colic (such as large colon impaction). The duration of colic signs before admission was of interest to the authors, as our facility is located on Prince Edward Island, servicing 4 Atlantic provinces in Canada, and long travel times to reach the hospital are common. Long travel times were also reported in western Canada with a median duration of colic signs of 12 h (10). These authors stated that the distance travelled to their hospital in western Canada may affect the severity of colic lesions and degree of intestinal damage, which would reduce the survival rate of surgical colics. Median duration of colic signs in our study was 16 h, possibly due to additional travel time. This may also in part explain the difference between survival rates of horses with both small and large intestine surgically treated lesions compared to studies in other geographic regions (15,25). These authors reported survival to hospital discharge for both strangulating small intestine lesions and large colon volvulus of 88% to 97% with median duration of colic signs before admission of 1.5 to 2 h (15,25). The results of our study may support that the severity of lesions increase with increased duration of colic signs since nearly 25% of horses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis by location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No diagnosis</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>&lt;0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Small intestine</td>
<td>14.27</td>
<td>5.96 to 34.14</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Large intestine</td>
<td>3.50</td>
<td>1.53 to 7.99</td>
<td>0.003</td>
</tr>
<tr>
<td>Severity of colic signs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None and mild</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>&lt;0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Moderate</td>
<td>3.09</td>
<td>1.71 to 5.58</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Severe</td>
<td>13.52</td>
<td>7.06 to 25.89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>&lt;0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Surgical</td>
<td>3.81</td>
<td>2.44 to 5.95</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.04</td>
<td>1.00 to 1.0</td>
<td>0.027</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>1.00</td>
<td>0.99 to 1.00</td>
<td>0.073</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mares</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>0.30&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stallions</td>
<td>1.58</td>
<td>0.88 to 2.84</td>
<td>0.129</td>
</tr>
<tr>
<td>Geldings</td>
<td>1.04</td>
<td>0.64 to 1.67</td>
<td>0.887</td>
</tr>
<tr>
<td>Duration of colic signs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 12 h</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>0.012&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>&gt; 12 &lt; 36 h</td>
<td>1.69</td>
<td>1.02 to 2.80</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt; 36 h</td>
<td>0.74</td>
<td>0.42 to 1.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Seen by eDVM before referral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>0.191&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>No</td>
<td>1.50</td>
<td>0.80 to 2.81</td>
<td>0.204</td>
</tr>
<tr>
<td>In or out of hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In hours</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>0.228&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Out of hours</td>
<td>1.32</td>
<td>0.83 to 2.12</td>
<td>0.233</td>
</tr>
<tr>
<td>Mentation on admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bright</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>&lt;0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Quiet</td>
<td>1.89</td>
<td>0.99 to 3.60</td>
<td>0.052</td>
</tr>
<tr>
<td>Depressed</td>
<td>5.46</td>
<td>2.96 to 10.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Agitated/Painful</td>
<td>7.92</td>
<td>3.86 to 16.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>GI-sounds on admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>Ref&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>&lt;0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Normal</td>
<td>0.75</td>
<td>0.03 to 0.20</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Decreased</td>
<td>0.29</td>
<td>0.16 to 0.54</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypermotile</td>
<td>0.04</td>
<td>0.01 to 0.017</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart rate on admission</td>
<td>1.03</td>
<td>1.02 to 1.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Respiratory rate on admission</td>
<td>1.02</td>
<td>1.00 to 1.04</td>
<td>0.007</td>
</tr>
<tr>
<td>Rectal temperature on admission</td>
<td>1.00</td>
<td>0.88 to 1.14</td>
<td>0.985</td>
</tr>
<tr>
<td>Abdominal lactate (mmol/L)</td>
<td>1.30</td>
<td>1.09 to 1.56</td>
<td>0.003</td>
</tr>
<tr>
<td>Abdominal total protein (g/L)</td>
<td>1.30</td>
<td>1.07 to 1.58</td>
<td>0.010</td>
</tr>
<tr>
<td>Peripheral lactate (mmol/L)</td>
<td>1.70</td>
<td>1.35 to 2.15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood glucose (mmol/L)</td>
<td>1.24</td>
<td>1.14 to 1.35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Leukocyte count (× 10&lt;sup&gt;9&lt;/sup&gt;/L)</td>
<td>1.01</td>
<td>0.95 to 1.07</td>
<td>0.729</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>1.10</td>
<td>1.07 to 1.13</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total protein (g/L)</td>
<td>1.01</td>
<td>0.99 to 1.03</td>
<td>0.356</td>
</tr>
<tr>
<td>Fibrinogen (g/L)</td>
<td>1.23</td>
<td>1.05 to 1.44</td>
<td>0.009</td>
</tr>
</tbody>
</table>

<sup>a</sup> Ref — reference category for categorical predictors, the odds ratio displayed for a category indicates the odds of non-survival compared to the odds of non-survival in the reference category.

<sup>b</sup> Overall P-values for categorical variables with more than 2 categories.
with colic that underwent surgery initially were euthanized under general anesthesia, presumably due to poor prognosis. For the horses that recovered from general anesthesia, survival was similar to other studies (7,11,20) and to medically treated horses in our hospital. This may indicate that while increased duration of colic signs may influence the initial chances of survival, the chances of survival after initial treatment may not necessarily differ from other populations. This prognostic information is valuable to referring veterinarians when advising clients on the treatment options, the possible outcome, and the need for rapid referral.

The diagnosis of equine colic from different hospitals and geographic locations varies, though many studies discuss that increased age, increasing severity of colic, and a lesion located in the small intestine. Knowledge of the common conditions, diagnostics, surgery, or post-mortem examination aid in diagnosis. Horses without diagnosis or lesion localization had the best odds of survival, which may be related to these cases often being medically managed and therefore not receiving surgical or post-mortem diagnosis.

Similar to the present study, large colon impaction was also the most common cause of colic in western Canada and in Denmark. However, in western Canada this was followed by large colon displacement and spasmodic colic (10,11), whereas in the present study the next most frequent diagnoses were large colon volvulus and right dorsal displacement of the colon. Although horses with large intestine colic had better odds of survival than those with small intestine causes in our study, the findings that large colon volvulus (a strangulating large intestine lesion) was the second most common diagnosis may have played a role in the decreased chances of survival of horses with large intestine lesions. These exclusively require surgical correction and increased duration of colic signs has been linked to decreased odds of survival for this particular lesion (15).

The main limitation of the present study lies in its retrospective nature, resulting in an incomplete data set and inability to clarify details or missing information. It was not possible to determine the reason for euthanasia in most cases, limiting interpretation of mortality rates, as it is unknown whether horses were euthanized due to poor prognosis or if other client factors, such as finances, were involved. The duration of colic signs and historical information depends on information from the owner, referring veterinarian, and conciseness of medical records; in many cases this would have been estimated.

In conclusion, in the Atlantic Canada equine population referred for colic, the most common diagnosis was large colon impaction followed by large colon volvulus. Our study found an association between increased risk of non-survival with increasing age, increasing duration of colic signs (between 12 and 36 h), increasing severity of colic, and a lesion located in the small intestine. Knowledge of the common conditions, outcome, and factors that affect survival in the region of practice is important for referring veterinarians when treating cases of equine colic in the field and advising clients.

Acknowledgment

The authors thank Dr. Melissa Smith for her help with data collection.

References


There was one odd misprint I discovered was when I was looking for information on chevron signs. I know that this is a common challenge that veterinarians can have interpreting dental radiographs — I recently took an online course in Dental Radiography, and many veterinarians in that course specifically stated that they wanted help learning how to differentiate these. When searching “Chevron Effect,” the index referred me to pages 122 and 154. There is a figure on page 122 (Figure B.8.7) with 2 pictures of chevron effects, both associated with the canine teeth. The third picture in the figure is a maxillary canine tooth with endodontic disease for comparison. Page 154 does mention the chevron effect, but it is just a summary list of key points of the chapter. However, there is another figure that is not referenced in the index on page 145 (Figure D.8.4) that also includes pictures of the chevron effect associated with the distal root of the maxillary fourth premolar, and both roots of the mandibular first molar, in addition to images of chevron signs associated with canine teeth. Given that the second figure was on page 145, and the index referred me to on page 154, I do suspect that this was a simple error in mixing up the order of the numbers. I cannot say how widespread this problem is within the book, but since that was a topic of interest for me, and I had difficulty finding all the information about it that is actually in the book, I thought I should mention it.

Overall, I liked this book a lot. It covers a broad range of topics and has interesting figures — such as the section in Dental Radiograph Interpretation Part A regarding the radiographic features of the teeth of different ages of cats and dogs. It has numerous radiographs of both normal and abnormal teeth and bones in small and exotic mammal species, as well as pictures of the gross appearance of different conditions. I found it easy to understand, with good annotations of the images, and clear explanations of the different pathologies presented. I think it would be a very useful, or, as the title promises, “practical” book for general practice veterinarians and veterinary students.

Reviewed by Teresa Bousquet, DVM, Park Veterinary Centre, Sherwood Park, Alberta.

Reference
Effectiveness of tapentadol hydrochloride for treatment of orthopedic pain in dogs: A pilot study

Nina R. Kieves, James Howard, Phillip Lerche, Jeffrey Lakritz, Turi K. Aarnes

Abstract — This pilot study evaluated the short-term analgesic effect of oral tapentadol hydrochloride (tapentadol) in dogs with unilateral hind limb lameness secondary to naturally occurring cranial cruciate ligament rupture. Baseline data including pharmacodynamic parameters, sedation scores, lameness scores, and objective gait analyses were collected. Tapentadol was administered orally (30 mg/kg body weight). Four hours following administration of tapentadol all data were collected again. Plasma concentrations of tapentadol 4 hours after administration were assessed using high performance liquid chromatography tandem mass spectrometry. No significant side effects were noted. All dogs had measurable plasma concentrations of tapentadol (mean concentration: 18.9 ng/mL). There were no significant differences in pharmacodynamic parameters or sedation over time. Subjective lameness scores were significantly lower than baseline at 4 hours post-drug administration. No significant improvement was seen in objective gait analysis. Further studies are needed to assess dosing regimens which may lead to effective treatment of acute pain and long-term use.

Résumé — Efficacité de l’hydrochlorure de tapentadol pour le traitement de douleur orthopédique chez des chiens : une étude pilote. La présente étude pilote a évalué l’effet analgésique à court terme d’hydrochlorure de tapentadol (tapentadol) chez des chiens avec une boiterie unilatérale d’un membre arrière secondaire à une rupture du ligament croisé antérieur se produisant naturellement. Les données de base obtenues incluaient des paramètres pharmacodynamiques, des pointages de sédation, des pointages de boiterie et des analyses objectives de la posture. Du tapentadol fut administré oralement (30 mg/kg de poids corporel). Quatre heures suivant l’administration de tapentadol toutes les données furent prises à nouveau. Les concentrations plasmatiques de tapentadol 4 heures après l’administration furent déterminées en utilisant la chromatographie à haute performance en phase liquide en tandem avec la spectrométrie de masse. Aucun effet secondaire significatif ne fut noté. Tous les chiens avaient des concentrations plasmatiques mesurables de tapentadol (concentration moyenne : 18,9 ng/mL). Il n’y avait pas de différence significative dans le temps pour les paramètres pharmacodynamiques ou la sédation. Les pointages subjectifs de boiterie 4 heures post-administration du médicament étaient significativement plus faibles que les valeurs de base. Aucune amélioration significative ne fut observée dans l’analyse objective de la posture. Des études supplémentaires sont requises pour évaluer les régimes de dosage qui pourraient mener à un traitement efficace de la douleur aiguë et de l’utilisation à long-terme.

Introduction

Numerous pharmaceuticals are available as oral analgesics including nonsteroidal anti-inflammatory drugs (NSAIDs), central-acting synthetic opiate-like (\(\mu\)-receptor) agonists (tramadol), gamma-aminobutyric acid (GABA) analogs (gabapentin, pregabalin), and \(N\)-methyl-D-aspartate (NMDA) receptor antagonists (amantadine) (1). The commercial availability and proven clinical efficacy of oral pain medications for dogs remain elusive outside the use of NSAIDs. The analgesic effect of oral opioids in dogs is limited by poor bioavailability (2,3). Recently, the use of tramadol was evaluated in dogs with chronic osteoarthritis and found to provide no improvement in objective gait analyses or pain scores compared with a placebo (4).

Gabapentin, an alternative neuropathic pain reliever, has unproven efficacy in small animal patients. Based on extrapolated data from clinically healthy dogs it is commonly prescribed at subtherapeutic doses and frequencies. The current literature supports the need for increased plasma concentrations to achieve clinically effective analgesia for gabapentin (2,5,6). Adjunctive oral medications such as amantadine are available, but take 42 d to reach therapeutic levels in dogs and provide no immediate treatment for acute pain (7). Therefore, NSAIDs remain the cornerstone of clinically effective oral analgesics (8). This reliance...
on NSAIDs poses risks and concerns for patients with underlying systemic disease and severely limits appropriate analgesia in certain populations of patients such as those with concurrent renal disease, hepatopathy, endocrine disease, gastrointestinal disease, or concurrent corticosteroid use. Consequently, there is merit in exploring if there are safe and effective oral analgesic alternatives to NSAIDs available for use in veterinary medicine.

Tapentadol hydrochloride (tapentadol) is a novel analgesic with widespread use in humans for treatment of chronic nociceptive and neuropathic pain and is approved for use in humans with diabetic neuropathies in the United States. In Canada, tapentadol is approved for use and is classified as a schedule 1 drug similar to other opioids. Tapentadol has a unique dual mechanism of action; it is a µ-opioid receptor agonist with norepinephrine reuptake inhibition (9). It lacks any clinically significant serotonergic activity. Additionally, the parent molecule (tapentadol) is the only active constituent with each known metabolite providing no analgesic potential in humans (10). Although the affinity of tapentadol for the µ-opioid receptor is 50× less compared with morphine, its analgesic potency is nearly identical and exhibits only a 2- to 3-fold decrease in efficacy (9,11). Moreover, in a recent study in dogs it was shown that tapentadol demonstrated a similar pharmacokinetic profile after oral administration in dogs compared to that in humans with a rapid first pass effect and oral absorption, minimal physiologic side effects, a comparable elimination half-life, and plasma concentrations within the established range of minimum effective plasma concentration in humans at all tested dosages [10, 20, and 30 mg/kg body weight (BW)] (12). This pharmacologic profile coupled with its lack of clinically significant side effects makes tapentadol an attractive oral analgesic for use in clinical canine patients.

The purpose of this study was to determine if a 30 mg/kg BW dosage of oral tapentadol would provide a clinically significant improvement in lameness in dogs with unilateral hind limb lameness caused by cranial cruciate ligament (CCL) rupture. This dosage was selected based on previous pharmacokinetic profiles (12). We hypothesized that oral tapentadol would provide pain relief evident as improvement in subjective and objective gait analyses.

Materials and methods

Study design

Dogs presented to The Ohio State University Veterinary Medical Center for unilateral hind limb lameness secondary to suspected naturally occurring CCL disease were enrolled prospectively in the study between February 2, 2017 and April 24, 2018. Owners were informed verbally of the study details and provided written consent before enrollment. The study was approved by the University Institutional Animal Care and Use Committee of The Ohio State University and Clinical Research Advisory Committee.

Participants

Client-owned animals examined for unilateral hind limb lameness attributable to CCL rupture diagnosed by physical examination were enrolled prospectively in the study. All dogs were fasted the morning the study was performed. Dogs were excluded if they had concurrent orthopedic disease resulting in lameness or neurologic disease identified by physical examination. Each dog underwent a full general physical, orthopedic, and neurologic examination by a Board-certified surgeon (NRK) to determine eligibility for enrollment. Prior to admission into the study a complete blood (cell) count (CBC) and serum chemistry profile were completed. Dogs were excluded if there were significant abnormalities noted on blood analysis or physical examination other than evidence of CCL rupture. Dogs were allowed to be on an NSAID during enrollment in the study, but other oral medications were withdrawn for a minimum of 1 wk before participating in the study.

Experimental design

Following enrollment in the study, baseline temperature, heart rate, body condition score (scale of 1–9) (13), thoracic auscultation, and sedation score were recorded. Sedation was evaluated using a validated 4-point scale (0 to 3), as previously reported (14), at baseline and 4 h after oral administration of tapentadol (Table 1). In addition, the lameness grade was evaluated and objective gait evaluation was performed using a previously validated pressure sensitive walkway (HRV Walkway 6 VersaTek System; Tekscan Animal Walkway System, South Boston, Massachusetts, USA) before administration of oral tapentadol (Nucynta; Janssen Pharmaceuticals, Titusville, New Jersey, USA). Lameness was graded on a scale of 0–5 (15), by a Board-certified surgeon (NRK) at baseline and 4 h after drug administration (Table 2).

An oral dosage of 30 mg/kg BW of tapentadol was calculated based on the current weight of the dog; the nearest dose based on available tablet size with reasonable splitting of tablets (quartering or halving with a pill cutter) was given orally with 85 g of Hills a/d wet food (Hills a/d; Hill’s Pet Nutrition, Topeka, Kansas, USA). Dogs were monitored to confirm that all food and tablets were swallowed.

Gait analysis

A previously validated pressure-sensitive walkway system was used to collect objective gait data. Ten video-recorded trials per dog were acquired before oral administration of tapentadol, and 4 h following dosing. Dogs were led over the walkway at a comfortable walk, with a velocity between 0.8 and 1.3 m/s and acceleration of ± 0.1 m/s². Five valid trials were averaged for statistical analysis. To be considered valid the dog must have been walking at a relaxed, steady walk without any overt disturbances and no signs of distress.

| Table 1. Sedation scoring system (14). |
|-----------------------------|-----------------------------|-----------------------------|
| Score | Description                      |
| 0     | No sign of sedation.            |
| 1     | Signs of sedation, but reactive to auditory stimulus. |
| 2     | Signs of sedation with no reaction to auditory stimulus, but reactive to physical handling. |
| 3     | Sedated, and unresponsive to handling and to auditory stimulus. |
Microcentrifuge tubes for storage. Plasma samples were frozen at \( -70^\circ C \) until they were assayed by high performance liquid chromatography tandem mass spectrometry (HPLC-MS/MS) (12).

Pharmacokinetic analytic method
Prior to enrollment blood samples were collected via puncture of the jugular vein with a 20-gauge needle for CBC and serum chemistry profiles to ensure the systemic health of the animal. A second blood sample was collected 4 h following drug administration. This was acquired via puncture of the saphenous vein in the clinically unaffected limb with a 22-gauge needle, or the jugular vein if blood could not be obtained from the lateral saphenous vein. This was saved for further analysis to determine plasma concentrations of tapentadol.

Immediately following collection whole blood samples were centrifuged at \( 2000 \times g \) for 20 min at \( 4^\circ C \). Plasma supernatant was aspirated from the collection tubes and placed into duplicate microcentrifuge tubes for storage. Plasma samples were frozen at \( -70^\circ C \) until they were assayed by high performance liquid chromatography tandem mass spectrometry (HPLC-MS/MS) (12).

Statistical analysis
Data for heart rate, rectal temperature, velocity, maximum force, impulse, maximum peak pressure, and symmetry were tested for normality using a Kolmogorov-Smirnov test. Normally distributed data were analyzed using a 2-tailed paired \( t \)-test. Data that were not normally distributed were analyzed using a Wilcoxon matched pairs test. Sedation and lameness scoring were analyzed using a Wilcoxon matched pairs test. \( P < 0.05 \) was considered significant.

Results

Descriptive analyses
Eighteen dogs were enrolled in the study. The mean age of dogs was 75.3 mo \( \pm \) 37.0 mo [standard deviation (SD)] (range: 19 to 149 mo), with a mean weight of 38.1 kg \( \pm \) 7.9 kg (range: 27.0 to 52.0 kg) and median body condition score of 6 (range: 5 to 9). Seven dogs had right hind limb lameness and 11 had left hind limb lameness attributable to CCL rupture based on physical examination findings. Radiographs in some dogs demonstrated variable degrees of stifle osteoarthritis and cranial displacement of the infrapatellar fat pad consistent with CCL rupture; others were diagnosed based solely on physical examination consisting of generalized muscle atrophy of the affected limb, medial buttress, joint effusion, pain with range of motion of the stifle, and instability consisting of positive cranial drawer and positive tibial thrust. Mean duration of lameness was 4 mo \( \pm \) 2.8 mo (range: 2 to 12 mo, with 2 dogs having unknown duration of lameness). Three dogs had a previous CCL injury surgically stabilized on the contralateral limb; this limb was non-painful with no lameness in all 3 dogs. Ten dogs were not on any oral medication at the time of enrollment, 6 received carprofen orally at a dose of approximately 2.2 mg/kg BW, q12h, and 1 dog received grapiprant (Galliprant; Aratana Therapeutics, Leawood, Kansas, USA), unknown dose. Of the 18 dogs enrolled, 10 underwent surgery to stabilize the CCL rupture with a tibial plateau leveling osteotomy (TPLO) after completion of the study. In all dogs undergoing surgery, a CCL tear was confirmed, with 7 dogs having a complete rupture of the CCL. 3 dogs having a partial rupture of the CCL, and 6 having a concurrent medial meniscal tear.

Pharmacodynamic analysis
The median calculated oral tapentadol dose was 1107.0 mg (range: 810 to 1560 mg) and the median nominal dose was 1112.5 mg (range: 800 to 1562 mg) or 30.04 mg/kg BW (range: 29.63 to 30.35 mg/kg BW).

Rectal temperature and heart rate were normally distributed. There was no significant difference in temperature (\( P = 0.1782 \)) or heart rate (\( P = 0.1461 \)) between the 2 time points (Table 3). Sedation scoring between baseline and 4 h post-drug administration was not significantly different (\( P = 1.000 \)). All dogs received a sedation score of 0 at baseline; at 4 h after drug administration 1/18 dogs (5.6%) was scored at 1 for sedation with all others having a sedation score of 0. One dog vomited approximately 1 h after receiving oral tapentadol with no evidence of tapentadol tablets in the vomitus and this dog did have measurable plasma levels of tapentadol; no other side effects were noted during the study. Respiratory rate was not statistically evaluated, as over 50% of the dogs were panting both at baseline and at 4 h after drug administration with no numerical value being recorded.

### Table 2. Lameness scoring system (15).

<table>
<thead>
<tr>
<th>Lameness score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No lameness.</td>
</tr>
<tr>
<td>1</td>
<td>Lameness difficult to observe and not consistently apparent with any gait.</td>
</tr>
<tr>
<td>2</td>
<td>Lameness difficult to discern at walk or trot, more apparent with circling or stairs.</td>
</tr>
<tr>
<td>3</td>
<td>Lameness consistently present at a trot.</td>
</tr>
<tr>
<td>4</td>
<td>Lameness obvious at a walk; intermittent non-weight-bearing lameness.</td>
</tr>
<tr>
<td>5</td>
<td>Non-weight-bearing lameness.</td>
</tr>
</tbody>
</table>

### Table 3. Temperature, heart rate, lameness, and sedation scores in 18 dogs before and after oral administration of tapentadol hydrochloride, 30 mg/kg body weight.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline (°C)</th>
<th>4 hours after drug administration (°C)</th>
<th>( P )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>39 ( \pm ) 0.6</td>
<td>38.8 ( \pm ) 0.4</td>
<td>0.1782</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td>126 ( \pm ) 26</td>
<td>115 ( \pm ) 23</td>
<td>0.1461</td>
</tr>
<tr>
<td>Sedation score</td>
<td>0</td>
<td>0 (0 to 1)</td>
<td>1.000</td>
</tr>
<tr>
<td>Lameness score</td>
<td>3 (1 to 4)</td>
<td>2 (1 to 4)</td>
<td>0.0147</td>
</tr>
</tbody>
</table>

Temperature and heart rate are presented as mean \( \pm \) standard deviation. Sedation score and lameness score are presented as median (range).
Subjective lameness scores were significantly lower than baseline at 4 h post-drug administration, indicating an improvement in lameness score ($P = 0.0147$). The median lameness score decreased from 3 to 2 over the course of the study (range: 1 to 4 at both time points).

**Gait analysis**

Velocity, maximum force (kg/m/s$^2$), impulse (%BW × s), and maximum peak pressure (PSI) were normally distributed, while maximum force (%BW), impulse (kg × s), and symmetry were not. Gait velocity was not different between baseline and 4 h post-drug administration. No differences were seen between baseline gait analysis variables and 4 h post-drug administration analysis (Table 4).

**Pharmacokinetic analysis**

All samples were found to have measurable plasma tapentadol levels at 4 h after drug administration when assessed with HPLC-MS/MS; mean: 18.9 ng/mL ± 9.1 ng/mL (range: 9 to 49 ng/mL). The relative SD values (an indication of the precision of the assay) were 4.7%, 3.7%, and 3.8% at 5, 25, and 100 ng/mL, respectively within days. Overall, values for the closeness of the found concentration to the amount added (accuracy) were 102.5%, 97.0%, and 94.9% at 5, 25, and 100 ng/mL, respectively within days. The mean recoveries from extracted plasma at 5, 25, and 100 ng/mL were 98.9%, 90.8%, and 91.9%, respectively.

**Discussion**

Our study demonstrated that a dosage of 30 mg/kg BW tapentadol administered orally lowered subjective lameness scores significantly in dogs with unilateral hind limb lameness attributable to CCL rupture 4 h after administration. There was, however, no corresponding statistically significant improvement in objective gait analysis as assessed by a pressure sensitive walkway system. Therefore, we reject our hypothesis that both subjective and objective lameness would improve with oral tapentadol administration in dogs with unilateral hind limb lameness secondary to CCL disease.

Although there was no statistically significant improvement in gait analysis values for maximum force, impulse, and maximum peak pressure of the affected limb, these did improve with time. It is possible that with a larger number of dogs enrolled in the study, a significant improvement in these objective assessments might be seen with oral administration of tapentadol. However, a blinded cross-over study with a control group would be best to elucidate any true effect oral tapentadol may have on acute pain relief in dogs. While dogs did not appear sedate from the drug, it is possible that they may have had some degree of sedation that was minor, experienced muscle relaxation, or cognitive dysfunction, which is seen in humans taking tapentadol (9); this change in demeanor could have hidden an improvement in lameness in the dogs. Furthermore, the validated sedation scoring system used in this study may not have provided the sensitivity necessary to discern a level of subclinical sedation that would still affect the gait analysis data. Alternatively, a single dose of oral tapentadol may not be an effective analgesic for dogs with CCL disease or osteoarthritis secondary to CCL disease.

Only 1 dosage of 30 mg/kg BW was given with assessment occurring 4 h after drug administration. This dosage and timepoint for plasma collection were selected based on a previous study of pharmacokinetics of oral tapentadol in dogs (12). In that study, the authors found that for a dose of 30 mg/kg BW, the plasma concentrations were highest at 4 h post-administration; therefore, this dosing and sampling point were chosen for this study (12). To ensure as uniform an absorption of drug as possible, all dogs were fasted the morning of the study. Additionally, all dogs were fed a high fat meal at the time of oral dosing as it is shown in humans that the AUC and $C_{\text{max}}$ of tapentadol increase 25% and 16%, respectively, following a high-fat and calorie dense meal (16). It is possible that more than 4 h and repeated dosing are needed to see improvement in pain status. Importantly, pharmacokinetic assessment showed measurable levels of tapentadol in plasma concentrations for all dogs in the study 4 h after dosing. Mean plasma concentration was 18.9 ng/mL, with a range of 9 to 49 ng/mL, which is within the known range of the minimum effective plasma concentration validated in humans to provide sufficient analgesia (17, 18). It is unknown what plasma level is required to achieve effective analgesia in dogs. It is possible that plasma concentrations need to be higher for demonstrable analgesia to occur. In a previous canine study, antinociception was demonstrated based on a tail flick test, but plasma concentrations of tapentadol were not evaluated (19).

Limitations of this study include the small number of dogs enrolled. An additional and substantial limitation to this study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>4 hours after drug administration</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity (m/s)</td>
<td>1.11 ± 0.13</td>
<td>1.09 ± 0.16</td>
<td>0.5466</td>
</tr>
<tr>
<td>Maximum force (%BW)</td>
<td>21.3 (10.2 to 51.5)</td>
<td>22.4 (7.8 to 52.2)</td>
<td>0.5135</td>
</tr>
<tr>
<td>Maximum force (kg/m/s$^2$)</td>
<td>8.15 ± 3.13</td>
<td>8.34 ± 3.24</td>
<td>0.5066</td>
</tr>
<tr>
<td>Impulse (%BW × s)</td>
<td>5.9 ± 2.52</td>
<td>6.28 ± 2.90</td>
<td>0.1941</td>
</tr>
<tr>
<td>Impulse (kg × s)</td>
<td>5.2 (2.5 to 13.3)</td>
<td>6.35 (1.9 to 13.0)</td>
<td>0.4458</td>
</tr>
<tr>
<td>Maximum peak pressure (PSI)</td>
<td>38.94 ± 8.36</td>
<td>39.56 ± 7.41</td>
<td>0.5132</td>
</tr>
<tr>
<td>Symmetry score</td>
<td>0.765 (0.29 to 3.49)</td>
<td>0.795 (0.43 to 3.1)</td>
<td>0.9434</td>
</tr>
</tbody>
</table>

Data are presented as mean ± standard deviation or median (range).

* Value is for the affected hind limb.
was the unblinded nature of the assessment. It was known to the observer assessing subjective lameness scores that all dogs were given oral tapentadol. This may have biased the observer to give an improved lameness score to the dogs at the post-drug administration assessment that was not seen with objective gait analysis. The caregiver placebo effect could account for the improvement in the subjective lameness scores seen, as there was no corresponding significant improvement seen in the objective gait analysis performed. Ideally, the observer should have been blinded to whether dogs received the drug or not. Additionally, a blinded crossover study design would have enabled us to better determine if an effect was present. Venipuncture at the 4 h post-oral dosing timepoint was most commonly performed in the non-lame hind limb. This may have affected gait analysis results if the venipuncture caused significant discomfort to the dog. This, however, would likely have improved the symmetry index, thereby making the dog seem more sound, and this was not seen. Therefore, it is unlikely that this affected the interpretation of the data.

Although no significant improvement was seen in objective gait analysis, there was a subjective benefit in the lameness assessment. This study only assessed the short-term effect of a single 30 mg/kg BW dosage of tapentadol. Therefore, it is possible that long-term dosing may show a significant objective improvement in dogs for chronic pain management, or possibly acute post-operative pain. If proven to be efficacious, tapentadol could be a valuable addition to pain management for chronic pain states such as osteoarthritis, and post-operative analgesia as an adjunct to, or instead of, an NSAID. Additional studies are warranted to assess if long-term dosing with tapentadol can provide analgesia for chronic pain management. These studies should include objective assessment as well as evaluation with a validated client questionnaire such as the Canine Brief Pain Inventory (20).

Importantly, no significant side effects were noted in the short-term with a single oral dose of tapentadol. One dog vomited at the time of administration, but this was unlikely due to the drug itself as it was immediately following ingestion. There were no changes in temperature or heart rate with any of the dogs enrolled, which supports the findings of Howard et al. (12), but differs from Giorgi et al. (18), in which dogs were noted to have increased panting when given IV tapentadol. Furthermore, a minor sedative side effect was seen in only 1 dog in this study. An analgesic that causes significant sedation is not desirable in dogs undergoing orthopedic or neurologic surgery, as sedation can be interpreted by owners as adequate pain management since dogs are not moving much or whining, when in fact the dog is simply too sedate to demonstrate clinical signs of pain.

This study showed a significant improvement in subjective, but not objective lameness evaluation over a short time frame with administration of a single dose of oral tapentadol at a 30 mg/kg BW dosage. No significant adverse effects were noted with this single dose administration. Further studies are indicated to determine if a cumulative effect on pain relief may be seen with multiple daily dosing.

Acknowledgments

The authors thank RVTs Kayci Deakney, Michelle Gilliam, Jimmy Quang, and Mary Ross, and Dr. Elizabeth Hoffman for their assistance in data collection. This study was supported by a grant from the ACVS Foundation and a grant from the Canine Research Funds of The Ohio State University.

References

Article

Prevalence and management of pain in dogs in the emergency service of a veterinary teaching hospital

Frédérik Rousseau-Blass, Elizabeth O‘Toole, Josée Marcoux, Daniel S.J. Pang

Abstract — A prospective, observational, cross-sectional study documenting the prevalence of pain in dogs presented to the emergency service of a veterinary teaching hospital and their handling (times to triage, examination, treatment) was conducted. Pain was assessed and compared using a validated and an unvalidated pain assessment scale. Sedation was monitored using a validated scale. A first evaluation was completed in 109 dogs. A second evaluation was completed for 95 dogs: 36 (38%) were identified as painful and 53% (19/36) were provided analgesia in the clinic. The remainder either did not receive analgesia (6/36, 17%) or were prescribed an analgesic for administration at home (11/36, 31%). Of dogs receiving analgesia in the clinic, most showed a decrease in pain score (15/19, 79%). Pain assessment scales were positively correlated ($r = 0.69, P < 0.0001$) but the unvalidated scale was insensitive in discriminating changes. Between painful and non-painful dogs, progression did not differ: admission to treatment ($P = 0.96, 95\% \text{ confidence interval (CI): } 223 \text{ to } 22 \text{ minutes}$) and examination to treatment ($P = 0.73, 95\% \text{ CI: } 14 \text{ to } 20 \text{ minutes}$). Suboptimal analgesic use suggests focused training in pain assessment and analgesic use guided by a validated pain assessment scale, is warranted.

Introduction

Pain is considered the 5th vital sign, after body temperature, heart rate, respiratory rate, and blood pressure, and veterinarians are aware of the importance of pain recognition and its central role in patient care and welfare (1–3). However, numerous surveys have shown that pain is under-recognized and under-treated in cats and dogs (3–9). A wide variety of underlying influences have been suggested for these shortcomings in pain management, including the number of animal health technicians working in a practice, concerns regarding side effects of analgesics, perception of pain associated with different procedures, limited understanding of drug pharmacology, year of veterinary graduation, (in)ability to assess pain, and the lack of a validated pain assessment scale (3–5,7,9).
With regard to the latter, a validated pain assessment scale for acute pain, the Glasgow Composite Measures Pain Scale-Short Form (CMPS-SF), has been available for dogs for over a decade, although its use in clinical practice is unknown (10). A strength of the CMPS-SF is the availability of an analgesic intervention threshold to aid decision-making in pain management and facilitate tracking of patient comfort during hospital visits (11).

The incidence of pain in dogs presenting to an emergency service has received little investigation, with 1 study reporting 56% (179/317) of dogs to be painful and with the primary causes of pain being orthopedic and dermatologic (primarily skin lacerations and bite wounds) (12). Analgesic treatment was provided in 66% (119/179) of the dogs identified as painful and therapy appeared effective in 61% (73/119). However, at the time of this study, no validated pain assessment scale was available for use in dogs and a numeric rating scale for pain assessment consisting of 3 items (behavior, movement, vocalization) was used.

The inadequate treatment of acute pain can result in chronic pain, although the underlying mechanisms of this transition are poorly characterized (13). Proposed theories for the transition to chronic pain include persistent noxious signalling from the periphery and a maladaptive response in the central nervous system, which includes descending inhibitory and facilitatory modulation dysfunction (13). There is currently insufficient evidence in veterinary medicine to establish the prevalence of this problem, though surveys of postoperative human patients suggest that prevalence may be as high as 40% in certain surgical populations and a recent feline study suggested an increased risk of chronic pain and adverse behaviors in cats that had been declawed (13,14). The timescale over which acute pain may establish the biological foundations required for the development of chronic pain syndromes is measured in hours to days (13). Therefore, early recognition and rapid and effective treatment of acute pain are important in the prevention of chronic pain syndromes.

The aims of this study were: i) to assess the prevalence of pain in dogs presenting to the emergency service, the incidence of analgesic treatment, and the evolution of pain during the observation period, and ii) to evaluate the trajectory of dogs as they entered the care pathway by quantifying the time from admission to treatment. A secondary aim was to compare the performance of an unvalidated pain scale against the CMPS-SF. We hypothesized that dogs identified as painful would receive analgesia and would be treated more rapidly than dogs with non-painful conditions.

**Materials and methods**

**Study design and ethical approval**

This cross-sectional observational study was conducted at the emergency service of the Centre Hospitalier Universitaire Vétérinaire de l’Université de Montréal. The study methodology was submitted to the institutional care and use committee before beginning the study and it confirmed that ethical approval was not required. The head of the intensive care department was aware of the study, and all other veterinarians or animal health technicians were blinded to the nature of the data collected. A sample size estimation was based on preliminary observations, with a sample size of 50 animals required to identify a mean difference in time from admission to treatment between painful and non-painful groups of 20 min with a standard deviation of 30 min (alpha 0.05, 90% power).

**Study population**

All dogs admitted to the emergency department during 36 selected weekends (Saturday and Sunday, between 0800 and 1800) were eligible for inclusion, except for critically ill patients requiring immediate care or dogs that had already been included in the study during a previous visit. The weekends were equally distributed from January to December 2017 and between 2 raters (FRB and JM).

**Data collection**

The evaluation process was as follows: after admission by reception, a triage examination was done by a student, animal health technician, or veterinary intern after which the dog was brought to the study evaluation room. Evaluation was completed by 1 of 2 investigators (FRB/JM) after a waiting period of 5 min during which the dog was not restrained and was free to explore the room. Pain was assessed using the CMPS-SF (without section B, scale range 0–20, intervention threshold ≥ 5) (11) and the Colorado Canine Acute Pain Scale (CCAPS; scale range 0–5, appendix 1) (15). Sedation level was evaluated using a validated sedation scale (16). Evaluations were completed within 5 min. The second evaluation followed the same steps as the first, taking place either after completion of the initial treatment plan (managed by the emergency department) or just before the dog was due to leave the hospital. Blinding to analgesic treatment was not always possible as assessors were following case progression in the hospital. In a pilot study, inter-rater agreement between the 2 raters was confirmed as “very good” (ICCsingle > 0.81) for the CMPS-SF and sedation scales. The following information was collected for the study: age, body mass, gender, reproductive state, breed, reason for admission, and number of active cases currently managed by the attending veterinarian. The following times were recorded to track patient handling: time of admission by reception, physical examination by a veterinarian (intern or clinician), and first treatment intervention (including potential analgesics). For animals that did not receive analgesia while in the hospital, admission and physical examination times were still included. For animals that did not receive a second evaluation, data from the first evaluation (pain and sedation scale scores) were still included.

Cases were categorized according to final diagnosis (with the exception of cases presented for euthanasia). Animals were excluded from the study if any of the following criteria were met: presence of sedation at first evaluation (score > 6/12), requirement for immediate treatment or aggressive behavior.

**Statistical analysis**

Data were entered in an electronic spreadsheet and analyses were performed using commercial software (Prism 6.07; GraphPad Software, La Jolla, California, USA). Non-parametric tests were applied after assessment of data distribution with a D’Agostino-Pearson omnibus normality test. Descriptive statistics of all cases are presented using proportions for categorical variables.
Approximately 1/3 of the dogs were identified as painful (n = 40) and non-painful (n = 69) dogs admitted to the emergency department. Dogs with a pain scale score of ≥ 5/20 were identified as painful. No diagnosis includes the dogs that were euthanized. The percentage above each column represents the proportion of painful animals.

More than half of the dogs presenting with dermatologic (67%), neurologic (62%), or orthopedic/trauma (54%) problems were painful (Figure 1) with the most common diagnoses being intervertebral disc disease (n = 6), bone fracture (n = 4), and skin lacerations (n = 4). Three of the 40 painful dogs were presented for euthanasia (CMPS-SF pain scores 8, 7, 7) and did not receive any analgesic treatment or a second evaluation, and 1 dog underwent surgery before the second evaluation could be performed. The remaining 36 painful dogs had second evaluations completed. Approximately half of these (19/36, 53%) received an analgesic treatment in the clinic, while 11/36 (31%) received an analgesic treatment for home administration and 6/36 (17%) did not receive an analgesic treatment (1 received an intramuscular corticosteroid injection). The most frequent treatments administered with the intention of providing pain relief were opioids, non-steroidal anti-inflammatory drugs, alpha-2 adrenergic receptor agonists, and gabapentin (Table 2).

Between the first and second evaluation, CMPS-SF pain scale scores decreased in 79% (n = 15/19) of dogs that received an analgesic within the clinic and 63% (n = 12/19) had scores decrease below the analgesic intervention threshold at the time of the second evaluation (Table 3). A small number of dogs (3/19) had an increase in CMPS-SF pain score over the course of the evaluations and 1 dog had no change in pain score. Sedation levels did not differ significantly between painful [1 (0, 6)] and non-painful [1 (0, 6)] animals at the first evaluation \( P > 0.99, 95\% \) confidence interval \( CI: 0 \) to 0, but painful animals that received analgesia had significantly higher sedation scores \( 3 (0, 8) \) compared to non-painful animals \( 1 (0, 5) \) at the second evaluation \( P = 0.0003, 95\% CI: 1 \) to 4).

Of the 17 painful dogs that did not receive analgesia during their time in the clinic, 10 had a decrease and 2 had an increase in CMPS-SF pain score between the first and second evaluations. Of those which had a reduction in pain score, 3 decreased below the analgesic intervention threshold (Table 3). One quarter of dogs (15/59) initially classified as non-painful showed an increase in GCMS-SF pain score, with scores exceeding the intervention threshold in 2 dogs (Table 3).

**Colorado Canine Acute Pain Scale**

The CCAPS and CMPS-SF scores were positively correlated at both the first \( r = 0.81 (0.73 \) to 0.87), \( P < 0.0001 \) and the second \( r = 0.69 (0.57 \) to 0.79), \( P < 0.0001 \) evaluations. However,
the evolution (change between first and second evaluations) of CCAPS scores differed from that of CMPS-SF scores. Of the 25 painful dogs that had a reduction in CMPS-SF score at the second evaluation, 14 were evaluated as having no change in score according to the CCAPS scale (Table 4). Similarly, 5 dogs identified as having an increase in CMPS-SF score were identified as showing no change in CCAPS scale (Table 4). Similar discrepancies between the CMPS-SF and CCAPS were observed for dogs initially identified as non-painful (Table 5).

**Patient handling time data**

For the time period from admission to examination, data from 3 painful dogs were unavailable (2 dogs euthanized, 1 time not recorded) to give a sample size of 37 dogs. For the same period, in the non-painful dogs, data from 6 dogs were unavailable (4 animals euthanized, 2 times not recorded) to give a sample size of 63 dogs.

The overall time, from admission to treatment, did not differ between painful and non-painful groups ($P = 0.96$, 95% CI: $-23$ to $22$, Figure 2A, B). The time from admission to examination by a veterinarian was significantly shorter in the non-painful than the painful animals ($P = 0.04$, 95% CI: 0 to 16, Figure 2A, B), but there was no difference from the time of examination to time of treatment ($P = 0.73$, 95% CI: $-14$ to $20$, Figure 2A, B). There was no significant difference in the number of active cases currently managed by the attending veterinarian between painful and non-painful dogs ($P = 0.08$, 95% CI: $-1$ to 0). The median time between the first and second evaluation by the investigator was 88 (18 to 270) min. The number of dogs evaluated within 30 min of initial treatment was 16, Figure 2A, B), but there was no difference from the time of examination to time of treatment ($P = 0.73$, 95% CI: $-14$ to $20$, Figure 2A, B). There was no significant difference in the number of active cases currently managed by the attending veterinarian between painful and non-painful dogs ($P = 0.08$, 95% CI: $-1$ to 0). The median time between the first and second evaluation by the investigator was 88 (18 to 270) min. The number of dogs evaluated within 30 min of initial treatment was 8/95. None of these dogs were in the painful group.

**Discussion**

In the present study, approximately 1/3 of dogs presenting to the emergency service exceeded the intervention threshold on the CMPS-SF ($\geq 5/20$) and were classified as painful. This is similar to the findings of 2 previous studies in a veterinary teaching hospital, in which the proportions of dogs identified as painful were 20% (outpatient population) and 56% (emergency service population) (12,18). A direct comparison between studies, particularly with regard to changes in level of pain, is limited by the substantial differences in the pain assessment scales that...
Table 4. Glasgow Composite Measures Pain Scale — short form (CMPS-SF) pain scores evolution (change between first and second evaluations) and the corresponding Colorado Canine Acute Pain Scale (CCAPS) evolution for painful dogs \((n = 36; \text{CMPS-SF} \geq 5/20)\) admitted to the emergency service.

<table>
<thead>
<tr>
<th>CMPS-SF evolution</th>
<th>CCAPS evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased ((n = 5))</td>
<td>0 increased</td>
</tr>
<tr>
<td></td>
<td>1 decreased</td>
</tr>
<tr>
<td></td>
<td>4 unchanged</td>
</tr>
<tr>
<td>Decreased ((n = 25))</td>
<td>2 increased</td>
</tr>
<tr>
<td></td>
<td>9 decreased</td>
</tr>
<tr>
<td></td>
<td>14 unchanged</td>
</tr>
<tr>
<td>Unchanged ((n = 6))</td>
<td>0 increased</td>
</tr>
<tr>
<td></td>
<td>0 decreased</td>
</tr>
<tr>
<td></td>
<td>6 unchanged</td>
</tr>
</tbody>
</table>

Table 5. Glasgow Composite Measures Pain Scale — short form (CMPS-SF) pain scores evolution (change between first and second evaluations) and the corresponding Colorado Canine Acute Pain Scale (CCAPS) for the non-painful animals \((n = 59; \text{CMPS-SF} < 5/20)\) admitted to the emergency department.

<table>
<thead>
<tr>
<th>CMPS-SF evolution</th>
<th>CCAPS evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased ((n = 15))</td>
<td>2 increased</td>
</tr>
<tr>
<td></td>
<td>0 decreased</td>
</tr>
<tr>
<td></td>
<td>13 unchanged</td>
</tr>
<tr>
<td>Decreased ((n = 12))</td>
<td>0 increased</td>
</tr>
<tr>
<td></td>
<td>2 decreased</td>
</tr>
<tr>
<td></td>
<td>10 unchanged</td>
</tr>
<tr>
<td>Unchanged ((n = 32))</td>
<td>0 increased</td>
</tr>
<tr>
<td></td>
<td>3 decreased</td>
</tr>
<tr>
<td></td>
<td>29 unchanged</td>
</tr>
</tbody>
</table>

were used. The current study used a published validated pain scale that includes an analgesic intervention threshold to identify pain and guide clinical decision-making. In contrast to the scale used by Wiese et al (12), the CMPS-SF was developed using psychometric principles (10,19) in a mixed hospital population. This approach, applied to a clinical population of dogs with diverse sources of pain, encompasses an established process of item selection, questionnaire construction, testing for validity, reliability, and sensitivity, and derivation of an analgesic intervention threshold in a clinical population (10,11). Therefore, it is likely that the CMPS-SF confers greater accuracy and reliability in pain assessment. Unfortunately, the CMPS-SF was not available at the time of the previous study. Notwithstanding this difference, the causes of pain reported here shared similarities with those reported by Wiese et al (12) for dogs presenting to an emergency service.

A validated pain scale confers the ability to accurately and precisely track changes in pain levels over time, allowing evaluation of pain control. In most cases, the provision of analgesia in the clinic was effective in decreasing pain to a level below the intervention threshold. This rapid efficacy as a result of providing in-clinic pain relief was highlighted in dogs in which pain was identified using the CMPS-SF but analgesia was not provided during the study observation period. A smaller proportion of these dogs had pain scores fall below the intervention threshold while a larger proportion remained painful. The dynamic nature of disease and pain is highlighted by the number of dogs in which pain scores increased between evaluations. This observation emphasizes the importance of regular pain assessment in patients, including those that have been given analgesics.

Encouragingly, despite structured pain assessment (with a pain scale) not being routinely performed on this population at this veterinary teaching hospital, the majority of painful dogs received analgesic treatment, either in the hospital or with at-home medication. These findings demonstrate a significantly higher percentage of analgesic therapy than previously reported in the veterinary literature, with approximately 66% use of analgesics in the emergency department (12) and 61% in the perioperative period for elective surgical procedures (20). Nevertheless, it is a concern that a small number of dogs were not given analgesia despite the presence of identifiable pain. This may reflect a lack of adequate recognition of pain or a reluctance to provide analgesia, both of which have been previously identified as barriers to analgesic therapy, with multiple underlying causes, including: lack of pain scores being incorporated into triage assessment, knowledge and attitude towards pain and the potential for gender or cultural bias, difficulty in assessing pain in this population, perceived side effects with analgesic usage, and concerns with the masking of clinical signs (3–5,7,21). Importantly, many clinical and experimental
studies have noted that the deleterious effects of pain outweigh perceived or possible adverse effects from the use of analgesic medications (22–25). Pain assessment and management can no longer be perceived as of secondary importance in the acute care setting. The prevalence of painful conditions reported here and in the literature underlines the value and importance of pain assessment and management (12,18). It should be a goal to provide effective analgesia to all painful patients presenting to an emergency service.

A secondary aim of this study was to compare the performance of the CCAPS alongside the CMPS-SF. The differences in the progression of pain identified using these scales points to weaknesses in evaluating and managing pain using an unvalidated pain scale. Additionally, the existence of an analgesic intervention threshold for the CMPS-SF provides a valuable guide for analgesic management in the use of this scale. While the scale developers do not claim that the CCAPS is validated, its ready availability and apparent simplicity make its use appealing (21). It is likely, though currently unconfirmed, that the limited number of scale items and combination of different behaviors within items adversely affect its discriminatory capacity and reliability (26).

Available validated pain assessment scales in dogs and cats include evaluation of behavioral responses and human-animal interaction. Therefore, the presence of sedation or behaviors affecting interaction (e.g., aggression) are potential confounding factors in the application of these scales (10,11,27–30). Sedation as a potential confounding factor was accounted for during development of the CMPS-SF by not including dogs that were sedated or otherwise recovering from the effects of anesthesia in the study population (11). In contrast to feline studies, the impact of sedation or behaviors affecting interaction with observers on pain assessment in a clinical canine population is unknown (27–29). The concurrent application of a sedation scale in this study limited the effects of this potential confounder at the first evaluation; however, the threshold to identify sedation was selected based on an investigator’s (DSJP) experience and has not been formally derived. The greater level of sedation observed in dogs following analgesic administration is predictable, as an effect of the agents used, and this may have impeded a behavioral response during pain assessment.

The period from admission to treatment encompasses early steps in the patient care pathway (admission at reception, initial evaluation and triage, examination by a clinician, and initiation of diagnosis and treatment) and reflects any delay in providing analgesia to a painful patient. The absence of significant difference in this period between dogs identified as painful and non-painful is a concern. The initial triage of all emergency admissions, occurring immediately following admission, represents a time when pain could be evaluated early; however, triage is performed by more junior staff or students and pain evaluation may not have been sufficiently emphasized in their assessment of the animal. A similar pattern was apparent following examination by a veterinarian, when the time to treatment in painful dogs did not differ from that for non-painful dogs. Surprisingly, the time from admission to examination was significantly longer in the painful group. The reasons for this are unclear and require further investigation. This is also an area of concern in human medicine, particularly in the emergency department, where adequate and timely pain management remains a challenge despite policies to meet time targets for analgesic administration (31,32). These delays indicate student and veterinary awareness of pain assessment and management should be a target for education (21).

Limitations of the study include a lack of blinding and variable assessment time for the second evaluation. The investigators were not blinded to treatment during the second pain and sedation evaluation. With the limited number of study personnel and the desire to not unduly influence case management by the ER service, it was necessary for the observers to collect treatment information. Therefore, though a risk of bias is present, this was limited to the second evaluation and did not affect the results of the first pain and sedation evaluation (and consequent estimate of pain prevalence) or the time data. Furthermore, the CMPS-SF was developed to assess pain and guide analgesic treatments in a clinical setting, such as that encountered here. Ideally, the timing of the second evaluation should have been tailored to the predicted onset of action of the analgesics administered. This was not controlled to maximize case collection and this limitation has minimal impact on the data as most cases in which the second evaluation was performed within 30 min of the first did not receive any analgesics. No conclusions can be drawn about pain in seriously ill dogs as this population was excluded from the study.

Recognition and assessment of pain is an integral part of veterinary clinical practice. This has been emphasized more in the last 20 to 25 years due to client expectations for pain relief in their pets, increased public awareness of issues surrounding the use of animals in biomedical research, and the veterinary clinical communities prioritizing the importance of pain control in clinical practice (2,3,33). In the present study, a significant percentage (36%) of the dogs presenting to the emergency service had signs consistent with pain above an interventional threshold. Regardless of the important implications of animal welfare and the veterinarian’s responsibility to relieve animal suffering (15), the prompt recognition and treatment of acute pain can influence many physiological factors: acute neuroendocrine changes, production of inflammatory cytokines, reduction of systemic stress, improving hemodynamic stability (22,23), prevention of postoperative complications (24,34) and prevention of chronic pain syndromes (35,36). Given the prevalence of painful conditions presenting to an emergency service analgesic therapy should be an integral aspect of therapy.

The timely identification and treatment of pain is a challenge in veterinary emergency medicine. Applying a validated pain assessment scale should form an integral part of patient triage and pain management. The use of analgesics remains suboptimal, suggesting that focused training in pain assessment and analgesic use is warranted.

Acknowledgments

The authors thank Dr. Guy Beauchamp for statistical support. DSJP receives funding from the Natural Sciences and Engineering Research Council of Canada (Discovery Grant...
References


Recent and current clinical trials in canine appendicular osteosarcoma

Andrew C. Poon, Arata Matsuyama, Anthony J. Mutsaers

Abstract — Osteosarcoma (OSA) is an aggressive primary bone tumor in the domestic dog that most often occurs within the appendicular skeleton. Despite the use of adjuvant chemotherapy, most dogs succumb to metastatic disease within 1 year of diagnosis. To improve this outcome, substantial research is currently focused on investigating novel therapies. Herein, we review emerging treatments and clinical trials that, if proven efficacious, could revolutionize the standard of care for canine appendicular OSA. This article includes a critical perspective on the safety, efficacy, and limitations of select immunotherapy, virotherapy, radiotherapy, targeted therapy, and personalized medicine trials, all of which reflect similar investigations taking place in human oncology. These clinical trials represent a major evolution in the overall approach to therapy for dogs with appendicular OSA that could have significant implications for improving survival.

Résumé — Essais cliniques récents et en cours sur l’ostéosarcome appendiculaire canin. L’ostéosarcome (OSA) est une tumeur osseuse primaire agressive chez le chien domestique qui se produit fréquemment dans le squelette appendiculaire. Malgré l’utilisation de chimiothérapie complémentaire, la majorité des chiens succombent aux métastases en dedans d’une année du diagnostic. Afin d’améliorer ce résultat, de la recherche substantielle est actuellement concentrée sur l’étude de thérapies nouvelles. À cet égard, nous révisons les traitements émergents et les essais cliniques qui, s’ils s’avèrent efficaces, pourraient révolutionner le standard de soins pour les OSA appendiculaires canins. Le présent article inclut une perspective critique de la sécurité, l’efficacité et les limitations d’un choix d’immunothérapie, de virothérapie, de radiothérapie, de thérapies ciblées et d’essais médicaux personnalisés, qui reflètent tous des investigations similaires effectuées en oncologie humaine. Ces essais cliniques représentent une évolution majeure dans l’approche globale à la thérapie de chiens avec OSA appendiculaire qui pourrait avoir des implications significatives pour améliorer la survie.

Can Vet J 2020;61:301–308

Introduction

Canine osteosarcoma (OSA) is an aggressive malignancy that accounts for up to 85% of all bone tumors in dogs. Incidence and risk factors are impacted by signalment. In a large population survey of 400 000 insured dogs in Sweden, the overall incidence reported was 5.5 cases per 10 000 dog-years at risk (1). Most canine OSA tumors originate in the metaphyseal region of bones in the appendicular skeleton (2). Reported risk factors for OSA development include sex, breed, history of trauma, and spay or neuter status. Female dogs may be at lower risk of developing OSA, with a reported hazard ratio of 0.71 based on a population study by Egenvall et al (1). Large and giant breed dogs (> 25 kg) are at highest risk, with breeds such as the Irish wolfhound and Leonberger having 126 and 72 cases reported per 10 000 dog-years at risk, respectively, in a Norwegian population study (3).

Affected dogs are typically presented with lameness and swelling that can be localized to the affected site. Due to tumor-related bone destruction, dogs with OSA are at risk for pathologic fracture, with 57.1% of these fractures reported to affect the femur, according to a study by Rubin et al (4). While radiographically detectable pulmonary nodules are present at diagnosis in less than 15% of cases, most dogs (90%) will have undetectable micrometastatic disease. Because of the high overall metastatic rate, the prognosis in canine OSA is poor. With treatment consisting of amputation and follow-up (adjuvant) chemotherapy, disease-free interval and overall survival times are typically what was reported by Selmic et al (5), namely 291 d and 284 d, respectively. With current standard therapies, long-term outcome for localized or disseminated disease have remained static over the past few decades. Thus, novel advances in the treatment of canine OSA are desperately needed.
Current efforts in the diagnosis, treatment, and prognosis of canine appendicular osteosarcoma

In the pre-operative setting, histological confirmation of OSA by bone biopsy may be necessary for definitive diagnosis; however, the biopsy procedure carries a risk of pathologic fracture. As a result, fine-needle aspiration cytology of the bone lesion may be used instead to identify sarcoma cells before histologic confirmation from the surgical specimen obtained at amputation (6). Upon diagnosis, 3-view thoracic radiographs are the minimum required imaging database to screen for evidence of pulmonary metastasis.

Standard of care. Amputation of the affected limb, followed by systemic chemotherapy is the current standard of care for appendicular OSA (5). In select cases, such as small tumors with minimal soft tissue involvement, limb-salvage procedures are considered (7). During a limb-salvage procedure, dogs require reconstruction of the bony defect through an allograft or prosthesis, then arthrodesis of the adjacent joint (7). Distal radial location is most favorable for limb-sparing due to good postoperative limb function (7). External beam radiation therapy is used for patient palliation and is indicated in dogs that do not undergo amputation or limb-sparing surgery (8). The overarching goal is to manage pain with minimal side effects. According to a study of 95 dogs with appendicular OSA, palliative radiation therapy leads to pain relief in 74% of dogs, with a median duration of response of 73 d (8). Bisphosphonates are also commonly prescribed in the palliative setting to reduce bone density loss, and have been combined in some settings with radiation therapy (9).

After limb amputation, adjuvant chemotherapy prolongs survival time to an average of 8 to 12 mo, compared to 3 to 5 mo without chemotherapy (10). Common drug protocols include the platinum agent carboplatin, or the anthracycline doxorubicin. For platinum agents, carboplatin is considered the drug of choice due to a lower risk of adverse events, such as nephrotoxicity, nausea, and gastrointestinal toxicity compared to cisplatin (11). When alternating the administration of carboplatin and doxorubicin in 50 dogs in the microscopic disease setting, no improvement in survival time was found compared to single-agent protocols (12). Moreover, in 35 dogs treated with cisplatin and doxorubicin combination therapy, 17 dogs (49%) experienced substantial toxicity that necessitated discontinuation of the treatment (13). In a recently completed phase III trial, the administration of carboplatin alone in 50 dogs led to a higher disease-free interval of 425 versus 135 d compared to alternating carboplatin with doxorubicin (14). Overall, a superior adjuvant chemotherapy protocol has yet to be defined.

Prognostic factors. Several prognostic factors for canine OSA have been reported, including elevated serum alkaline phosphatase (ALP), location of the affected bone, age, and weight. A meta-analysis of these factors concluded that elevated serum ALP and proximal humerus location were significant negative prognosticators (15). Although age is often reported as a risk factor, increasing age did not have significant correlation with disease-free interval and survival time (16). Dogs with an elevated serum ALP at diagnosis had shorter survival compared to dogs with serum ALP within the reference range, with a hazard ratio of 1.62. In a separate prognostic study of 65 appendicular OSA cases, pre-operative proteinuria was clinically associated with poor outcomes (17). Furthermore, dogs with OSA confined to the distal radius had the best prognosis (17). When investigating weight in 54 cases of OSA, underweight dogs had significantly shorter survival times than ideal or overweight dogs, while obesity was not specifically associated with adverse outcomes (18).

Novel clinical trials for canine appendicular osteosarcoma

Canine OSA benefits from extensive research efforts and the ongoing work of many clinical trials. Previous clinical and basic research into canine cancer and immunology have paved the way for a new generation of trials. This emerging forefront of novel therapies may directly impact the future management of canine appendicular OSA. The following categories reflect the current landscape of next-generation therapies being investigated in human oncology. Along with their novelty, potential limitations, and challenges of each treatment are discussed. In addition, a summary of publicized clinical trials for canine OSA obtained from the American Veterinary Medical Association Animal Health Studies Database at the time of manuscript submission (https://ebusiness.avma.org/aaahsd) is presented in Table 1.

Immunotherapy trials. The use of immunotherapy to treat human malignancies continues to expand, leading to significant tumor control in advanced lymphoma, melanoma, lung, and bladder cancer. Accelerated interest into further application of immunotherapy partially stems from the success of recent human trials blocking cytotoxic T-lymphocyte-associated protein 4 (CTLA-4) and programmed cell death protein (PD1) (19,20). Yet, to date, few studies have examined the potential clinical use or translation of immunotherapy in dogs.

Autologous activated T-cell therapy. The historical use of autologous T-cell therapy for canine OSA dates to adoptive transfer of a xenogeneic, human cytotoxic T-lymphocyte line (TALL-104) after amputation plus cisplatin therapy in 23 dogs with OSA (21). This set a landmark for the development of other vaccines, monoclonal antibodies, and immunomodulators. Preliminary results from a novel autologous T-cell study in 15 dogs with appendicular OSA were recently reported (22). The technology is based on the collection of cancerous OSA tissue from the patient and preparation of an intradermal pre-vaccination series 14 d before apheresis, using canine-specific settings (e.g., for cell size). The collected lymphocytes are expanded in the presence of interleukin-2 (IL-2), after which the activated cells are infused back into the patient.

Among the 15 dogs enrolled in this clinical trial, 12 completed apheresis for the infusion procedure, and 10 completed the activated T-cell therapy (ACT). For dogs receiving ACT, the disease-free interval was 213 d. At the time of reporting, the median survival time of all dogs in the study (including those that did not receive ACT or IL-2) was 339 days, but MST was not reached for dogs that received ACT.

Based on the Veterinary Co-operative Oncology Group-Common Terminology Criteria for Adverse Events (VCOG-CTCAE) scale, few low-grade toxicities (I or II) were observed,
including local erythema, vomiting, and diarrhea. Grade III gastrointestinal toxicities were observed in 1 patient before the administration of premedications (i.e., NSAIDs, anti-nausea medications).

**HER2/neu targeting Listeria vaccine.** A recombinant vaccine (ADXS31-164) targeting human epidermal growth factor receptor 2 (HER2/neu) was developed using an attenuated, recombinant *Listeria monocytogenes* vector. HER2 is an oncogene that is classically overexpressed in various human cancers (e.g., mammary cancer), and is also widely expressed in canine OSA, particularly in cancer stem cells, where it is suggested to lead to reduced response to chemotherapy and shorter survival times (23). In multiple mouse models of primary cancer, recombinant *L. monocytogenes* delivery elicits cytotoxic T-lymphocyte activity by infecting mononuclear cells and stimulating potent antitumor immunity.

In a phase I dose escalation clinical trial, 18 client-owned dogs that completed the standard of care were enrolled to receive intravenous (IV) infusions of the vaccine at a dose of either $2 \times 10^5$, $5 \times 10^8$, $1 \times 10^9$, or $3.3 \times 10^9$ colony-forming units (CFU) every 3 wk for 3 administrations. Before administration of vaccine ADXS31-164, the dogs also received 1 dose of ondansetron [0.2 mg/kg body weight (BW)] to prevent nausea and vomiting, and 1 dose of diphenhydramine (2 mg/kg BW) to prevent anaphylaxis. Dogs that were free of metastatic disease for 5 mo after treatment were offered additional IV infusions every 4 to 6 mo at a dose of $1 \times 10^9$ CFU.

The vaccine broke peripheral tolerance against HER2+ OSA tumors, with strong evidence of an interferon-gamma (IFN-\( \gamma \)) specific response. Furthermore, the vaccine led to increased tumor-associated T-lymphocyte infiltration, and subsequently lower incidence of metastases when compared to a historical group treated with amputation and carboplatin alone (23). For the 18 dogs treated with ADXS31-164, the median disease-free interval was 956 d compared to 123 to 257 d for amputation and carboplatin alone. Overall 1- and 2-year survival rates were reported to be 77.8% and 67% for the vaccine group, compared to 35.4% and 10% for amputation plus carboplatin, respectively. No dose-dependent effect of ADXS31-164 on HER2/neu-specific immunity was found. Dogs that were “early responders” developed IFN-\( \gamma \)-specific responses within 3 wk of administration, and dogs that were “late responders” developed responses within 2 to 6 mo.

Only low-grade (1 or II) transient toxicities were observed within the dose range investigated, the most common of which were hypertension (19/23) and thrombocytopenia (13/23). Since the immune targeting of HER2 has been reported to cause cardiotoxicity in human cancers, cardiac status was evaluated.

---

**Table 1. Summary of selected clinical trials for canine osteosarcoma treatment, based on studies submitted to AAHSD (AVMA Animal Health Studies Database) or the Comparative Oncology Trials Consortium (COTC).**

<table>
<thead>
<tr>
<th>Trial</th>
<th>Type</th>
<th>Target</th>
<th>Phase</th>
<th>Title</th>
<th>Primary institution</th>
<th>Trial ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palladia</td>
<td>Targeted therapy</td>
<td>KIT</td>
<td>NA</td>
<td>Toceranib phosphate (Palladia) and carboplatin combination chemotherapy in dogs with naturally occurring cancer.</td>
<td>Kansas State University</td>
<td>AAHSD000179</td>
</tr>
<tr>
<td>Rapamycin</td>
<td>Targeted therapy</td>
<td>mTOR</td>
<td>I</td>
<td>Evaluation of orally administered mTOR inhibitor rapamycin in dogs in the adjuvant setting with osteosarcoma.</td>
<td>Multi-institutional (United States, Canada)</td>
<td>COTC021</td>
</tr>
<tr>
<td>GD2, GD3</td>
<td>Targeted therapy</td>
<td>GD2/3</td>
<td>I</td>
<td>A ganglioside targeted cancer vaccine for canine osteosarcoma: A phase 1 trial.</td>
<td>University of Florida</td>
<td>AAHSD000140</td>
</tr>
<tr>
<td>ADXS31-64</td>
<td>Vaccine/Immunotherapy</td>
<td>HER2/Neu</td>
<td>I</td>
<td>Evaluation of an ADXS31-164 (a recombinant, attenuated <em>Listeria monocytogenes</em> expressing a chimeric human HER2/neu protein) in dogs in the adjuvant setting with osteosarcoma.</td>
<td>Multi-institutional (United States and Canada)</td>
<td>COTC026</td>
</tr>
<tr>
<td>VSV-IFN( \beta )-NIS</td>
<td>Oncolytic virotherapy</td>
<td>IFN( \beta ), NIS</td>
<td>I</td>
<td>Defining pharmacokinetics and biological activity of systemic oncolytic VSV within a dose-schedule optimization study.</td>
<td>Multi-institutional (United States)</td>
<td>COTC024</td>
</tr>
<tr>
<td>NV-01</td>
<td>Vaccine/Targeted therapy</td>
<td>NGF</td>
<td>II</td>
<td>Open-label, phase II trial of NV-01 for pain palliation in dogs with osteosarcoma.</td>
<td>University of Illinois, Colorado State University</td>
<td>AAHSD000018, AAHSD000063</td>
</tr>
<tr>
<td>COXEN</td>
<td>Genomics</td>
<td>NA</td>
<td>NA</td>
<td>Predictive models of drug response in canine osteosarcoma: A prospective clinical trial testing the COXEN approach.</td>
<td>Colorado State University</td>
<td>AAHSD000089</td>
</tr>
<tr>
<td>SRT</td>
<td>Radiotherapy</td>
<td>NA</td>
<td>NA</td>
<td>Stereotactic radiation therapy for pain relief and immune modification in dogs with limb osteosarcoma.</td>
<td>University of Wisconsin</td>
<td>AAHSD00072</td>
</tr>
<tr>
<td>SRT</td>
<td>Radiotherapy</td>
<td>NA</td>
<td>NA</td>
<td>The analgesic and systemic immune response to stereotactic radiation therapy in canine osteosarcoma.</td>
<td>University of Wisconsin</td>
<td>AAHSD000263</td>
</tr>
</tbody>
</table>

NA — not applicable.
by echocardiography and serum cardiac troponin I levels. No significant or sustained changes in cardiac parameters were identified.

**Recombinant Salmonella expressing IL-2 vaccine.** Orally administered, attenuated and genetically engineered *Salmonella enterica* serovar Typhimurium encoding IL-2 (SalpIL2) was developed and tested in combination with amputation and adjuvant doxorubicin (24). The innate biodistribution of *Salmonella* spp. in hypoxic or anaerobic environments makes this an attractive vector for the delivery of intratumoral immunotherapy. IL-2 is a pleiotropic cytokine released early during an immune response. The mechanism of action of SalpIL2 involves immune-mediated cytotoxicity, leading to the immunogenic killing of *S. typhimurium*-infected tumor cells.

SalpIL2 was administered to 19 client-owned dogs (*3 × 10^6 CFU/kg BW*) in a phase I clinical trial at the University of Minnesota. The dose was given at day 0, after which amputation was performed at day 10, and doxorubicin chemotherapy started 2 wk after. Safety and efficacy were the primary and secondary measures, respectively.

The therapy led to disease-free intervals ranging from 69 to 880 d with a median of 199 d (24). Three of the 19 dogs did not develop metastases during the study period. Dogs treated with a lower dose of SalpIL2 had longer disease-free intervals than dogs treated using the highest SalpIL2 dose. Although toxicities were observed, they were not attributed to the administration of SalpIL2.

**Limitations and challenges.** Success in immunotherapy is challenged by poor immunogenicity of cancers and difficulty in overcoming tumor-induced immune suppression. Developing immunotherapy regimens that are consistently effective for each patient and identifying biomarkers of response to immunotherapy are often difficult. For autologous T-cell therapy, factors such as availability of apheresis centers and turnaround times must be considered. Administration of pre-medicants, such as non-steroidal anti-inflammatory drugs (NSAIDs) or anti-nausea medications for ACT, may further reduce the incidence of adverse effects in dogs. Live, attenuated cancer vaccines have the potential to invoke strong immune responses by enhancing antigen delivery through microbial delivery systems, yet this approach could pose risks for immunocompromised patients. Safety and quality control of the treatment should be considered a priority for dogs receiving live attenuated vaccines.

**Virotherapy trials**

Virotherapy is a strategy that directs the use of viruses for primary or metastatic tumor cell destruction. Viruses can be exploited as vectors for the delivery of exogenous agents or to mediate tumor cell destruction (oncolytic virotherapy). When used to illicit an immune response, virotherapy is considered a form of immunotherapy.

**Adenoviral gene therapy.** In canine OSA, neoadjuvant gene therapy with delivery of a replication-deficient adenovirus vector (Ad-FasL) was tested for intratumoral activation of FasL (25). FasL is a type II transmembrane secreted protein member of the tumor necrosis factor family that, upon engaging with the Fas “death receptor” (CD95 or APO-1), mediates apoptosis. In previous studies involving anti-Fas antibodies, there was evidence of apoptosis in Fas+ tumors; however, this treatment led to high lethality in mice due to engagement of Fas antigen in the liver, leading to fulminant hepatitis (26).

A phase I trial involving Ad-FasL delivery in 56 dogs with appendicular OSA was completed. Administration of Ad-FasL was followed by the standard of care after a 10-d delay. This period of delay was based on preclinical data showing statistically significant immunologic protection in animals treated after 10 d with FasL gene transfer. Ad-FasL delivery demonstrated significant survival improvement (98 wk versus 37 wk in historical controls) in dogs with high inflammation or high lymphocyte infiltration scores (>1), especially in tumors that expressed low levels of FasL. This result suggests that Ad-FasL may be most effective when OSA tumors fail to express, or express low levels of FasL. Inflammation, apoptosis, or necrosis following FasL activation resulted in better outcomes (25). However, survival in dogs with low inflammation scores (<1) was not different from the current standard of care.

Overall, the phase I data concluded that gene therapy with viral vectors can be safely administered due to the replication-deficient nature of adenoviruses. Transient increases in aspartate transaminase and creatine phosphokinase were observed, but with no attributable clinical symptoms. Of the 54 dogs that were evaluated, 22 had no reportable toxicity, 26 exhibited grade I or grade II toxicity, 4 exhibited grade III toxicity, and 2 had grade IV toxicity. Both cases of grade IV toxicity involved hypotension and azotemia that were not attributed to the administration of Ad-FasL.

**Vesicular stomatitis virus.** VSV-hIFN-NIS is a recombinant vesicular stomatitis virus (VSV) engineered to express interferon beta (IFNβ) and the sodium-iodide symporter (NIS). In a preliminary syngeneic model of murine myeloma, single shot systemic therapy with VSV-hIFN-NIS resulted in tumor-specific uptake and viral replication, leading to tumor remission (27). IFNβ enhances specificity of VSV and activates innate immunity to initiate antiviral responses. Specific replication of the virus is monitored by single-photon emission computerized tomography (SPECT)/CT imaging, using a NIS-specific radiotracer.

A pre-clinical dose-escalation study was first performed in purpose-bred, healthy beagles to define a safe systemic dose range (28). Systemic VSV therapy at a tissue-culture infective dose (TCID) of 1 × 10^10 TCID_{50}/0.5 m² was well-tolerated, and 10-fold dose-limiting toxicities included hepatotoxicity and coagulopathy. Eight client-owned dogs with a variety of spontaneous cancers were then recruited, and this dose-feasibility trial defined the pharmacokinetics (PK) and biological activity of systemic oncolytic VSV (29). Within this study, 2 intravenous doses of VSV-hIFN-NIS were delivered to 1 client-owned dog with metastatic maxillary OSA, showing tumor-specific virus replication and delayed viral decay. The dog exhibited stable disease for 6 mo before progression of the primary lesion. No shedding of the virus was observed in urine or buccal swab samples of all 8 dogs, and correlative PK studies demonstrated elevated levels of VSV RNA in the blood.
Transient hepatotoxicity resolved in 2/8 dogs following systemic VSV-hIFN-NIS treatment.

**Limitations and challenges.** Efficacy and specificity of the virus are often considered key limitations in the use of virotherapy. Many oncolytic viruses have favorable safety and toxicity profiles and are potent anti-cancer agents *in vitro*, but demonstrate limited clinical efficacy as a single agent (30). Accurate delivery of the virus to the target tumor tissue remains a challenge for virotherapy. Multi-site injections when compared to IV injections have shown promise in enhancing immune responses to virotherapy. Due to the replication-deficient nature of the virus, specificity is also of concern, and viral modifications may be necessary to increase specificity. Establishment of alternate regimens, such as the evaluation of combined therapies may improve responses to virotherapy.

**Radiation therapy trials**

Radiation therapy (RT) is often the treatment of choice in the palliative setting to alleviate local pain, but newer technologies may be offered with curative intent. The killing of tumor cells or the inhibition of osteoclast-mediated osteolysis are factors that may contribute to pain reduction. Radiation treatment typically involves 2 to 4 relatively large doses given once per week, after which pain relief begins in 70% of dogs after 11 to 15 d, and lasts for 60 to 120 d (8). Combined chemotherapy and RT have also been shown to be more effective than radiation therapy alone (9).

**Bisphosphonates and radiation therapy.** With the introduction of aminobisphosphonate therapy in dogs with appendicular OSA, more studies are aimed at determining their effects as single agents and in combination with radiation therapy. Aminobisphosphonate reduces malignant osteolysis by inducing osteoclast apoptosis. An early study by Fan et al (31) showed that single agent pamidronate treatment in 43 dogs with appendicular OSA provided durable pain relief in 12/43 dogs, lasting a median of 231 d.

Aminobisphosphonate therapy generally has a safe toxicity profile, although a recent case report highlighted osteonecrosis of the jaw as a possible complication of long-term use of the potent NBP zoledronate in the management of OSA complications, which has also been reported in human NBP use and pediatric OSA (32). Additionally, in a retrospective study of 50 canine appendicular OSA cases, addition of pamidronate to RT resulted in a decreased MST of 69 d compared to 309 d for combination chemotherapy and RT (9). Due to the retrospective of the study, it is possible that bias towards combination therapy for cases with more severe signs existed, and prolonged use of NBPs with RT in dogs requires further prospective evaluation.

**Stereotactic radiation therapy.** For dogs that are poor candidates for amputation or limb-sparing procedures, stereotactic radiation therapy has been evaluated as an advanced treatment technique. Stereotactic radiation therapy involves the administration of high dose fractions of radiation (20 to 30 Gy) to the target site using an external radiation beam, sparing surrounding tissues with submillimeter accuracy (33). Conventionally used to treat brain tumors in human patients (34), select veterinary radiation oncology practices have investigated stereotactic radiation delivery systems for the treatment of appendicular canine OSA. Unfortunately, a multi-institutional retrospective review of 18 dogs treated with stereotactic radiation therapy concluded that stereotactic radiation therapy led to major complications, the most common of which were surgical site infections and pathological fractures, with 9 dogs facing amputation at a median of 152 d (35). The major disadvantage of stereotactic radiation therapy may be that pathological fractures are extremely difficult to repair. Fracture repair using internal fixation could be considered a viable treatment for pathologic fractures in tumors that have been treated with stereotactic radiation therapy, using either an open approach or minimally invasive percutaneous osteosynthesis (MIIPO) (36). The high risk for fractures may also justify prophylactic stabilization (35).

Overall, stereotactic radiation therapy when combined with surgery, could be considered a high-risk procedure for the dog. Alternatively, curative-intent methods other than stereotactic radiation therapy could be considered for canine appendicular OSA treatment (35).

**Limitations and challenges.** Despite the goal of only irradiating the tumor, radiation therapy does not exclusively target tumor cells. Whether radiation therapy is delivered with curative or palliative intent, development of pathologic fracture and radiation side effects should be considered during the protocol. Generally, radiation adverse effects, such as erythema, edema, and desquamation can be self-limiting (37) and are less common with palliative protocols. However, late side effects in tissues with slow turnover (i.e., bone) can lead to tissue fibrosis, necrosis, loss of function, or death, though these effects are less likely in the acute pain palliation setting. Radiation therapy is often contraindicated for sites of pathologic fracture. Therefore, appropriate patient selection, with careful consideration and planning must be performed before beginning a radiation therapy protocol.

**Targeted therapy trials**

Molecular targeted therapy involves the specific targeting of the cancer's genes, proteins, or the tumor microenvironment to induce tumor remission. This approach often involves treatment with a monoclonal antibody, leading to specific targeting of proteins, or small molecule inhibitors, which lead to modulation of pathway expression in cancer.

**Targeting of receptor tyrosine kinases.** Toceranib (Palladia) is an oral receptor tyrosine kinase inhibitor approved by the US Federal Drug Administration for the treatment of Patnaik grade II or III, recurrent, cutaneous mast cell tumors with or without regional lymph node involvement in dogs. This drug is considered one of the first targeted therapies available in North America for canine cancer treatment. A safety evaluation of combination carboplatin and Palladia was performed in dogs with various cancers, including OSA (38). The protocol was well-tolerated overall, with the dose-limiting toxicity for Palladia administration being neutropenia.

The efficacy and clinical benefit of Palladia, which is defined as an objective response or stabilization of macroscopic disease, is reportedly limited with canine OSA treatment (39–41). The
concurrent addition of Palladia to metronomic cyclophosphamide did not improve outcomes in microscopic disease, and the use of Palladia may not lead to reliable clinical responses of pulmonary macroscopic metastases (41,42).

**Targeting of mTOR pathway.** A systematic genomewide screen in OSA identified dual phosphatidylinositol-4,5-bisphosphate 3-kinase (PI3K) and mammalian target of rapamycin (mTOR) inhibition as a conserved therapeutically vulnerable area in OSA (43). Clinically, a dose escalation study of the mTOR inhibitor rapamycin determined a safe and active pharmacological oral dose in 22 dogs with appendicular OSA (44). This parenteral formulation resulted in the modulation of the mTOR pathway targets in tumor and peripheral blood mononuclear cells (PBMC), even at low doses of 0.01 mg/kg BW, compared with high doses at 0.08 mg/kg BW (44). AKT is a serine-threonine kinase that is implicated in downstream signaling and activation of mTOR. However, in rapamycin treated tumors, no differences in AKT expression or phosphorylation levels were observed. No serious adverse effects were reported from the study, but self-limiting grade I or II toxicities that could be attributed to rapamycin administration include vomiting, diarrhea, anorexia, and thrombocytopenia. While rapamycin clearance could not be studied due to the long half-life of the drug, plasma accumulation was evident at day 15 (44). Further results of this parenteral formulation are expected during the optimization of drug schedules and clinical trial evaluation. To this end, the Comparative Oncology Trials Consortium (COTC) of the US National Cancer Institute has been prospectively evaluating rapamycin in the adjuvant setting following limb amputation and chemotherapy. Results of this large multi-institutional clinical trial have not yet been released.

**Targeting of nerve growth factor.** Targeting skeletal pain ligands associated with nociceptors has been suggested to improve pain control, particularly in canine OSA, where local pain is often associated with tissue injury from inflammation (45). Moreover, because not all patients are elected for amputation due to coinciding nervous system or joint diseases, pain management in the palliative setting is often necessary for these patients.

Nociception in nerves of the normal bone is known to be controlled by the nerve growth factor (NGF) (46). An open-label, phase II trial has begun for pain palliation in canine OSA using a fully caninized, monoclonal antibody against NGF (NV-01), based on evidence that canine OSA cells express and secrete NGF ligands (45). In a pilot study involving kaolin injections into the canine footpad to mimic lameness and inflammatory pain, 32 research dogs were recruited for induction of paw inflammation (46). The degree of lameness was scored, then NV-01 was administered IV and compared to meloxicam or phosphate-buffered saline administration. The recovery period ranged from 7 to 14 d, after which the dogs were returned to the colony.

NV-01 was extremely well-tolerated and reduced signs of lameness comparable to meloxicam treatment. No adverse effects were observed over the 2-week monitoring period. Pharmacokinetic analysis revealed a distribution phase half-life of approximately 12 h and an elimination phase half-life of approximately 9 d. For meloxicam, significant improvement in lameness scores (compared to placebo) was observed at 6 h and on days 1, 5, 6, and 7. With NV-01 delivered IV, significance in lameness reduction compared to placebo was observed on days 1, 3, 6, and 7.

**Limitations and challenges.** Innate and acquired resistance to targeted therapy is a challenge faced by numerous human and veterinary targeted cancer therapy trials. Intrinsic resistance is often characterized by de novo activation of signaling pathways independent of the signaling target initially inhibited (47). Clonal evolution of resistant mutants is acquired to tumors to develop a diminished response to targeted therapy. This clonal outgrowth can produce unfavorable long-term outcomes for patients receiving monoclonal antibodies or small molecule inhibitors. Off-target side effects of targeted therapies are also of concern, which can lead to unique and dose-limiting toxicities. During clinical development, careful consideration of potential resistance mechanisms may lead to better targeting and drug combination approaches to improve long-term outcomes.

**Metronomic chemotherapy**

Low dose metronomic chemotherapy is an investigational treatment that may be incorporated concurrent and sequential to standard of care adjuvant chemotherapy or used in the palliative gross disease setting. This treatment approach involves use of a low dose, continuous administration of a chemotherapeutic, such as the alkylating agent cyclophosphamide. Due to toxicities reported at high doses, the metronomic approach for drug dosing may achieve clinical benefit without the same toxicity profile seen at the maximum-tolerated dose. Low dose metronomic chemotherapy has been reported to inhibit both tumor angiogenesis and immune suppressive regulatory T-cells, while conventional chemotherapy at the maximum-tolerated dose, kills rapidly dividing tumor cells.

In a retrospective study of 50 dogs treated with chronic LDM cyclophosphamide, adverse effects were observed that resulted in discontinuation of treatment in 22 dogs (44%), while 16 dogs (32%) developed sterile hemorrhagic cystitis leading to irritant bladder symptoms and hematuria (48). Moreover, metronomic chemotherapy has also been combined with toceranib phosphate (Palladia) and was found to have no improvement on the disease-free interval after amputation and carboplatin chemotherapy (42).

**Limitations and challenges.** Prospective clinical trial validation for the benefit of LDM chemotherapy in veterinary oncology is currently lacking. The administration of cyclophosphamide with an LDM schedule warrants additional monitoring for cystitis, especially after high cumulative doses.

Despite a generally well-tolerated acute toxicity profile, chronic administration of LDM chemotherapy may be associated with potential complications.

**Personalized medicine trials**

Personalized medicine is a strategy that separates patients into groups based on predictions about their individualized response to treatment. High throughput research models such as genetic models of disease allow for the robust prediction of potential...
treatment efficacy. In canine OSA, a gene expression model has been recently developed for doxorubicin and carboplatin treatment by comparing the drug sensitivity data of canine OSA cell lines and tumor datasets (49). Through a bioinformatics approach, predictions in differential gene expression were made in canine OSA tumor samples, and then matched with the clinical outcome of patients after chemotherapy treatment in a retrospective setting. Dogs whose treatment matched the predictions in gene expression had significantly better clinical outcomes, leading to longer disease-free intervals (49). The prediction of drug response may direct future decisions regarding the choice of chemotherapeutic or experimental therapy.

**Personalized medicine algorithms (Pmed).** A recent pioneering effort among US veterinary hospitals also supports that personalized medicine is feasible as an approach for OSA treatment. This multi-site study adopted personalized medicine algorithms involving genomic profiling and bioinformatics to look at the feasibility of determining suitable therapies for an individual dog with an average turnaround time of 5 business days (50). After submission, the samples were verified by quality control for RNA quality prior to processing, after which the personalized medicine algorithms report was relayed to the attending veterinarian. Of the 20 patient samples submitted, 13 were successfully profiled, while others were hindered by either pathology or RNA quality control failure (50). Based on the report, opinions that were communicated from attending veterinarians about feasibility of the process were overall positive, with constructive information provided that could potentially guide further clinical trials.

Although Pmed approaches at present are performed with single gene evaluations for Palladia and masitinib in dogs with mast cell tumors, there is potential translational value of conducting personalized medicine for treating future OSA cases. As such, this client-tailored approach may soon be part of a powerful armamentarium for monitoring drug resistance and the decision-making process. Prospective clinical trials are warranted to assess the impact of such approaches on the prognosis of dogs with OSA.

**Limitations and challenges.** Personalized medicine remains a growing and immature field that relies heavily on technology and human interpretation of patient data. This data generation and interpretation can raise issues with cost, confidentiality, and potential ethical concerns. Despite these challenges, personalized approaches have strong potential to see routine implementation into the clinic as the ability to genetically interrogate tumors becomes faster and easier. In veterinary oncology, and in the specific setting of canine appendicular OSA, policies regulating use and interpretation of this genetic data may be necessary.

**Conclusions**

Canine OSA remains the most common aggressive primary bone tumor in dogs. The chronology of amputation or RT followed by chemotherapy is standard treatment that many dogs face when diagnosed with this disease. A wealth of past research into canine OSA, cancer biology and immunology may soon begin to pay clinical dividends. With emerging therapeutic strategies, such as immunotherapy and targeted therapy, owners increasingly have access to new treatment options for their companion animals. In addition, even more personalized medicine may soon open additional doors for owners to expand upon currently available therapeutic opportunities. In veterinary oncology, pinpointing realistic molecular targets for canine appendicular OSA has tremendous potential in halting its metastatic progression. It is important to note that, because many of the results of the novel therapy trials reported herein remain inconclusive, more research is warranted to translate such therapies into a new validated standard of care.

While outcomes with conventional surgery and chemotherapy may have plateaued over the last several years, novel therapeutic approaches, currently under investigation based on decades of preclinical investigation, see the OSA field poised to make strides in the future to significantly extend survival of dogs affected by this aggressive disease.

**Acknowledgment**

We regret that there were clinical trials that could not be cited in this review due to space limitations.

**References**

Aortic thromboembolism in a basset hound-beagle crossbred dog with protein-losing nephropathy

Kathryn Gardiner

Abstract — A 12-year-old neutered male basset hound-beagle crossbred dog with a history of protein-losing nephropathy was presented because of acute weight-bearing right hind limb lameness and intermittent splaying. The condition was painful and progressed to non-ambulatory paraparesis. The dog was referred to an emergency and specialty hospital where a diagnosis of aortic thromboembolism was confirmed. This case illustrates the challenge in diagnosing and determining the cause of aortic thromboembolism in dogs.

Résumé — Thrombo-embolisme aortique chez un chien croisé basset-beagle affecté de néphropathie avec perte de protéines. Un chien castré croisé basset-beagle âgé de 12 ans avec une histoire de néphropathie avec perte de protéines fut présenté à cause d’une boiterie avec appui postérieur droit d’apparition aiguë accompagnée de parésie du train postérieur et évasement intermittent. La condition était douloureuse et progressa à une paraparésie non-ambulatoire. Le chien fut référé à une clinique d’urgence et de spécialité où diagnostic de thrombo-embolisme aortique fut confirmé. Ce cas illustre le défi que représente de diagnostiquer et déterminer la cause de thrombo-embolisme aortique chez les chiens.

membranes were injected, and a grade I/VI left-sided heart murmur was auscultated. The bladder could no longer be expressed on palpation and frequent catheterization was required, which became increasingly difficult. No significant improvements in ambulation were seen and the left hind limb nailbeds became cyanotic. On account of the patient’s worsening condition and discomfort, the owners elected euthanasia.

Discussion

Aortic thromboembolism (ATE) is recognized as a common complication of cardiac disease in cats. In conditions such as hypertrophic cardiomyopathy, abnormal blood flow in an enlarged left atrium can result in thrombus formation with embolization to the distal aorta (1,2). Feline patients suffering from ATE are commonly presented in pain with an acute onset of paraparesis or paraplegia, weak or absent femoral pulses, cold distal limbs, and nail and footpad cyanosis (3). In dogs, on the other hand, ATE is rare (4) and often associated with a predisposing condition such as an immune-mediated disease, neoplasia, systemic inflammation, sepsis, cardiac disease, protein-losing nephropathy (PLN), protein-losing enteropathy, or systemic hypertension (2,5–8). However, in some cases of ATE in dogs, there are no concurrent conditions and no cause is identified (9).

In contrast to the acute clinical presentation of ATE in cats, dogs can be presented with more chronic clinical signs, such as exercise intolerance with few motor or neurological deficits (6). These dogs are often less severely affected and have longer survival times compared to those that are presented with acute clinical signs (4,6). It has been suggested that the chronicity of clinical signs in some patients could be attributed to the extensive collateral circulation of the canine pelvic limbs, or to incomplete obstruction of blood flow (10,11). There are reports of dogs with blood flow remaining through or around an aortic thrombus (4). If there had been more blood flow remaining through or around the part of the thrombus extending into the right femoral artery of the patient in the present case, this may have explained why the deficits were worse in the left hind limb. It is difficult to know why the patient originally displayed right hind limb lameness. With mild fluid distension noted on radiographs of the right stifle, it is possible that the patient’s initial clinical signs were worse in the right hind limb due to a pre-existing injury or arthritis.

Systemic hypertension has been associated with ATE in dogs (8). The systemic hypertension reported in the present case may have been due to stress associated with the patient’s condition or hospitalization (12). It is possible that systemic hypertension contributed to the development of ATE in this case, or that hypertension caused by stress exacerbated the condition. Since blood pressure measurements were not taken prior to, or at the time of initial presentation, the role of systemic hypertension in the development of ATE in this case is not known. Aortic thromboembolism has also been reported as a potential consequence of cardiac disease in dogs (2). The low-grade heart murmur detected herein was not identified at initial presentation and no echocardiography was performed to confirm cardiac disease as a potential predisposing factor to ATE. Nonetheless, this case might support including careful cardiac auscultation and echocardiography as diagnostic procedures in cases of pelvic limb motor and neurological dysfunction.

The patient in the present case had a history of glomerulonephritis, for which he was managed long-term on benazepril (20 mg, PO, q24h). Protein-losing nephropathy (PLN) has been reported as the most common concurrent disease in dogs with ATE (8). The thromboembolic complications associated with PLN may be due to a decrease in antithrombin activity owing to urinary loss (2,13,14). Additionally, plasma α-globulins are often elevated in patients with PLN and this portion of the serum contains the clot-promoting factors prothrombin and factor VIII (14). The cause of thromboembolism in the present case was not confirmed; however, the literature suggests that the patient could have been in a hypercoagulable state due to PLN, which predisposed him to ATE. There is evidence to suggest that we cannot predict the occurrence of thromboembolism in patients with renal disease based on the degree of proteinuria, hypertension, hypoalbuminemia, or decreased antithrombin activity (15). Nevertheless, it may be prudent to consider aortic thromboembolism as a differential diagnosis in dogs with renal disease that present with hind limb lameness. This case might also support prophylactic anticoagulant use in patients with PLN.

Although not confirmed, it would appear that PLN predisposed the patient in the present case to ATE. Dogs with ATE may not always present with acute pain, cold limbs, absent femoral pulses, and paraparesis or paraplegia, as one might expect since this is the classic presentation of ATE in cats (1,3). The clinical signs of ATE in dogs can be more chronic and non-specific, making it a challenging disease to diagnose. Further studies are needed to provide a better understanding of the conditions that predispose dogs to ATE so that it may be prevented or suspected and diagnosed early in the course of disease.

Acknowledgments

Thank you to the veterinarians and staff at Brooklin Veterinary Hospital for an educational, supportive, and welcoming externship experience. A special thanks to Dr. Melissa Andrew and Dr. Nadia Rosanova for allowing me to take part in this case and for their support in writing this manuscript.

References


While you’re taking care of them, we’re looking out for you.

Specialized insurance programs and risk management services for CVMA members

- Professional liability insurance
- Commercial insurance
- Employee benefits
- Individual life and disability
- Student and graduate insurance
- Personal auto and home insurance

CVMA INSURANCE PROGRAM

1-866-860-2862 • cvmainurance.com
Exciting! Inspiring! Motivating!
Excitant! Inspirant! Motivant!

Join peers and colleagues and be exhilarated by old Quebec charm and hospitality.

Attend CVMA signature events, stellar continuing education, AND MUCH MORE!

Joignez-vous à vos pairs et collègues et laissez-vous envier par le charme et l’hospitalité du Vieux-Québec.

Assistez aux événements de marque de l’ACMV, à la formation continue exceptionnelle et plus encore!

In collaboration with | En collaboration avec:

CANADIAN VETERINARY MEDICAL ASSOCIATION
L’ASSOCIATION CANADIENNE DES MÉDECINS VÉTÉRINAIRES

canadianveterinarians.net

tvttc
veterinaresaucanada.net
Aural hematoma and its treatment: A review

Jennifer Hewitt, Jangi Bajwa

**What is aural hematoma?**

An aural hematoma (Figure 1) is a blood-filled subcutaneous fluctuant swelling on the pinna formed when traumatic rupture of the capillaries and separation of the auricular cartilage and skin occurs. It may be unilateral or bilateral and can affect both dogs and cats, although cats are much less frequently affected (1). Patients are generally presented with a history of head shaking or intense scratching of the ear(s) (1). In the early stages of development, the hematoma can be warm to the touch, the skin may be erythematous, and the pet may experience discomfort (2). A sero-hemorrhagic, fibrotic rich fluid is aspirated early in the formation of an aural hematoma (2). During normal healing, the fluid resorbs and fibrosis occurs; contraction of the fibrotic tissue results in malformation of the pinna (2).

**What causes aural hematoma?**

Pruritus or non-pruritic mechanical trauma to the ear pinna may result in the formation of an aural hematoma in dogs and cats. Additionally, an underlying immunologic disease has been proposed as a potential cause (3,4). Primary and secondary factors involved in otitis result in pruritus of the ear (Table 1). Hypersensitivity reactions, in particular atopy and food reactions are primary causes of otitis in dogs, which account for 43% of all cases of otitis (5). In cats, 50% of otitis cases are due to *Otodectes cyanotis* mites (1). Control and/or treatment of the primary causes of otitis is necessary to prevent the secondary causes of otitis and aural hematoma formation and recurrence. While treating any otic condition including aural hematoma, diagnosis and treatment of a concurrent...
secondary ear infection is key towards resolution and prevention of recurrence.

**Differential diagnoses:** Pinna abscess, cyst, or neoplasia.

**Key point:** An aural hematoma is not a diagnosis; it is a sequela of pruritus or trauma to the ear. Treatment of the underlying otitis including the primary, perpetuating, and predisposing factors, is absolutely necessary to prevent recurrence and ensure that resolution of the hematoma is successful.

### How do we treat aural hematoma?

#### 1. Medical management

Medical management is the most common treatment choice on initial presentation and is reported to have the best cosmetic outcome in dogs and cats (6). This form of treatment is minimally invasive and reduces costs as sedation is not typically required. It is ideal for early onset or smaller hematomas. This form of treatment typically includes draining of the hematoma with a needle and instillation of an intra-lesional steroid with daily oral steroid treatment (3,7). Additionally, the use of intra-lesional steroid injection(s) alone or oral steroid administration alone has been reported (3,4,8). A variety of intra-lesional steroids including methylprednisolone, triamcinolone, and dexamethasone have been reported (3,4,7–10). A novel treatment with platelet rich plasma (PRP) has been described for intra-lesional injection with 2 dogs successfully treated (11) (Table 2).

**Helpful tips:**
- Always perform an otoscopic examination and ear cytology.
- Aseptically prepare the concave surface of the pinna before drainage to minimize contamination and abscess formation.
- The use of a butterfly needle (19 or 21 gauge) and line (Figure 2) is very effective for drainage, flushing, and subsequent instillation of intra-lesional steroid to minimize repeated puncture of the skin surface. This approach also helps minimize patient discomfort and stress associated with repeated puncture of the aural skin.

**Triamcinolone** is more commonly reported for intra-lesional use in recent years (6,10).

#### 2. Surgical management

Various surgical approaches have been described in the literature. Surgery is the most common treatment choice for recurrent or persistent hematoma in dogs and cats (6). The most commonly reported approach is a linear incision with sutures (6). All surgical approaches are performed under heavy sedation or general anesthetic, and the pinna is aseptically prepared. Cotton balls or gauze placed in the ear canal before drainage to minimize contamination and abscess formation. The contents of the hematoma, particularly fibrin clots, are evacuated by massaging and flushing with sterile saline after an incision into the hematoma is made. A 1/4” fenestrated latex drain is sometimes used to facilitate drainage over a period of several days (12). The drain is sutured in place (12).

**A. S-shaped or linear incision:** An incision is made through the concave surface of the pinna overlying the hematoma. Multiple staggered, full thickness or partial thickness, interrupted mattress sutures are placed parallel to the long axis of the pinna over the entire area of the hematoma (3,12). Alternatively, a continuous intra-dermal suture line performed on the inner surface of the hematoma has been described (13).

**B. Cannula technique:** A large bore needle (14 or 16 gauge) is used to evacuate the contents of the hematoma and the trimmed teat cannula is inserted through the needle hole. It is sutured in place (12).

**C. Placement of a drain:** A 1/4” fenestrated latex drain is sutured in place at either end and runs the length of the hematoma (12,14).

**D. Multiple circular fenestrations:** A 4-mm or 6-mm dermal biopsy punch is used to make multiple openings over the entire surface of the hematoma. Simple interrupted sutures are placed along the skin edge of each punch. The use of a CO₂ laser has been reported to achieve the same outcome with 1- to 2-mm sized openings created over the surface of the hematoma with a single 1-cm sized opening to facilitate most of the drainage (15).

---

**Table 1. Primary and secondary causes of otitis in dogs and cats (1).**

<table>
<thead>
<tr>
<th>Primary causes of otitis</th>
<th>Secondary causes of otitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hypersensitivities (atopy, food reactions, contact reactions)</td>
<td>• Bacterial infection</td>
</tr>
<tr>
<td>• Parasites</td>
<td>• Yeast infections</td>
</tr>
<tr>
<td>• Foreign body</td>
<td>• Otitis media</td>
</tr>
<tr>
<td>• Inflammatory polyps</td>
<td>• Chronic pathological changes to the ear (e.g., aural hematoma, calcification of ear canal, ceruminous gland hyperplasia, inflammatory mass in ear canal)</td>
</tr>
<tr>
<td>• Endocrine disorders</td>
<td></td>
</tr>
<tr>
<td>• Neoplasia</td>
<td></td>
</tr>
<tr>
<td>• Keratinization disorders</td>
<td></td>
</tr>
<tr>
<td>• Juvenile cellulitis (auto-immune)</td>
<td></td>
</tr>
<tr>
<td>• Conformational abnormalities</td>
<td></td>
</tr>
</tbody>
</table>
E. Closed suction drainage: The tubing of a butterfly catheter is altered by removing the hub and fenestrating the end of the tube. A small incision is made into the hematoma and the tubing is inserted and secured with sutures. Constant negative pressure is maintained with a Vacutainer (1,3,8,13).

3. Benign neglect

An aural hematoma will resolve without treatment, as long as the underlying etiology is treated. The result is potentially severe morphological changes to the pinna and ear canal (2). With significant malformation of the ear, permanent changes to the anatomy of the pinna may potentiate recurrent otitis. Clients with concerns regarding costs of treatment, steroid use, or general anesthetic may prefer this course of treatment.

Table 2. Summary of dosing for intra-lesional treatments (3,4,6–11).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose and Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tramcinolone</td>
<td>1 to 10 mg (0.1 to 1.6 mL) every 7 d for 1 to 3 wk. Concurrent oral prednisone or prednisolone at 0.125 to 1 mg/kg body weight (BW) q24h for 10 to 14 d tapering after 7 d.</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>10 to 40 mg (0.5 to 1 mL) every 7 d for 1 to 3 wk.</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>0.2 to 0.4 mg (diluted in saline) every 24 h for 1 to 5 d.</td>
</tr>
<tr>
<td>Autologous platelet-rich plasma (PRP)</td>
<td>0.5 mL derived from whole blood, no steroids used in course of treatment.</td>
</tr>
</tbody>
</table>

Final thoughts

The prognosis for aural hematoma in dogs and cats is good to excellent as long as the underlying etiology is addressed. It is important to remember that unless trauma to the ear has occurred, development of an aural hematoma is not a primary condition. Primary, predisposing, and perpetuating factors leading to otitis and/or aural hematoma development need to be addressed to have successful resolution of the hematoma. Always remembering to perform an otoscopic examination and otic cytology at initial presentation and at recheck examination will significantly aid in management of otitis.

References

One of the most distinguished, enlightening and lively events of its kind, the ABVMA’s annual CanWest Veterinary Conference offers a vibrant array of continuing education opportunities. Hosted at the Fairmont Banff Springs Hotel, CANWESTCONFERENCE.CA

Program and registration available in July at: CANWESTCONFERENCE.CA

Clinical Education, Communication and Practice Management Skills...

Surrounded by the Beautiful Rocky Mountains!

Hosted at the Fairmont Banff Springs Hotel

One of the most distinguished, enlightening and lively events of its kind, the ABVMA’s annual CanWest Veterinary Conference offers a vibrant array of continuing education opportunities.
Let the good times roll: Results of the 2019 CVMA Practice Owners Economic Survey
La conjoncture continue d’être favorable, d’après les résultats de l’enquête économique auprès des propriétaires d’établissements vétérinaires de l’ACMV menée en 2019

Chris Doherty

Canadian veterinarians continued to prosper in 2019, as the national veterinary economy expanded for the 4th consecutive year, attaining new record highs in several key metrics. Across both companion animal and mixed and large animal hospitals, revenues grew, expenses remained under control, and net incomes advanced.

Companion animal hospitals
Canadian companion animal hospitals benefited primarily from surging revenues, with the national weighted average climbing to $631,517 per full-time equivalent (FTE) DVM, an increase of 6.7% year-over-year. As would be expected with revenue growth, expenses increased in 2019, rising by 5.7% from 2018, to a national weighted average of $430,937 per FTE DVM. With the escalation in revenue outpacing that of expenses, companion animal hospitals were able to boost their net incomes by 7.2%, to a national weighted average of $200,580 per FTE DVM (Figure 1).

While the average figures across all of Canada paint a rosy picture, there were, as usual, some provinces that registered

Dr. Doherty is a graduate of the Ontario Veterinary College and he works as an economic analyst for the Ontario Veterinary Medical Association.
This article is provided as part of the CVMA Business Management Program, which is co-sponsored by IDEXX Laboratories, Petsecure Pet Health Insurance, Merck Animal Health, and Scotiabank.
Address all correspondence to the CVMA Business Management Committee; e-mail: admin@cvma-acmv.org
Use of this article is limited to a single copy for personal study. Anyone interested in obtaining reprints should contact the CVMA office (hbroughton@cvma-acmv.org) for additional copies or permission to use this material elsewhere.

Le Dr Doherty est diplômé de l’Ontario Veterinary College et travaille en tant qu’analyste économique pour l’Ontario Veterinary Medical Association.
Le présent article est rédigé dans le cadre du Programme de gestion commerciale de l’ACVM, qui est cocommandité par IDEXX Laboratories, Petsecure Insurance, Merck Santé animale et la Banque Scotia.
Veuillez adresser toute correspondance au Comité de la gestion commerciale de l’ACMV (admin@cvma-acmv.org).
L’usage du présent article se limite à un seul exemplaire pour étude personnelle. Les personnes intéressées à se procurer des réimpressions devraient communiquer avec le bureau de l’ACMV (hbroughton@cvma-acmv.org) pour obtenir des exemplaires additionnels ou la permission d’utiliser cet article ailleurs.
above average results, and others that came in below average. Nova Scotia, Alberta, and British Columbia companion animal hospitals all had revenue growth that was well above the national weighted average. However, Newfoundland & Labrador and Prince Edward Island suffered declines in gross revenue. Saskatchewan companion animal hospitals saw their revenue stagnate, and growing expenses resulted in a drop in net incomes.

Examining non-DVM expenses as a percentage of revenue, Canadian companion animal hospitals did see a minor uptick from 2018 to 2019, from 68.0% to 68.3%, yet this remains well below the recent high-water mark of 69.6% in 2016 (Figure 2).

Comparing expenses as a percentage of revenue allows for a meaningful comparison across time, between practices of various sizes, and in different parts of the country. For example, a larger hospital, generating more revenue, will invariably have a higher dollar amount of expenses when compared to a smaller hospital that generates less revenue. By expressing their expenses as a percentage of the revenue each generates, it becomes possible to assess efficiency against benchmarks.

Though the financial metrics of companion animal hospitals provided much cause for celebration, client metrics once again showed very little positive change. Current clients declined by 0.9% from 2018 (Figure 3).

Taken together, the financial and client metrics indicate that the average Canadian companion animal veterinarian is seeing fewer clients than even a couple years ago yet is more than making up for this through increased fees, greater compliance, and higher spending from each individual pet owner. This playbook has worked out very well in recent years, as demonstrated in previous figures, but there will eventually be a need to staunch the decline in clients, particularly if the overall Canadian economy encounters a rocky patch and clients rein in their spending.

In an ideal world, a hospital would maintain their current client numbers, attract a healthy number of new clients to replace natural attrition, continually work on improving compliance, de compagnie ont pu augmenter leurs revenus nets de 7,2%, pour une moyenne nationale pondérée de 200 580 $ par médecin vétérinaire ETP (figure 1).

Bien que les résultats moyens dans l’ensemble du Canada brossent un tableau positif, il y a, comme d’habitude, certaines provinces qui ont enregistré des résultats supérieurs à la moyenne, et d’autres où les résultats sont inférieurs à la moyenne. Les établissements vétérinaires pour animaux de compagnie de la Nouvelle-Écosse, de l’Alberta et de la Colombie-Britannique ont tous connu une croissance des revenus bien supérieure à la moyenne nationale pondérée. Cependant, ceux de Terre-Neuve-et-Labrador et de l’Île-du-Prince-Édouard ont subi une baisse de leurs revenus bruts. Les établissements vétérinaires pour animaux de compagnie de la Saskatchewan ont vu leurs revenus stagné et, par conséquent, l’augmentation des dépenses a entraîné une baisse de leurs revenus nets.

En examinant les dépenses non-DVM en pourcentage des revenus, les établissements vétérinaires canadiens pour animaux de compagnie ont vu une légère augmentation de 2018 à 2019, passant de 68,0 % à 68,3 %, mais cela reste bien en deçà du recent sommet de 69,6 % observé en 2016 (figure 2).

La comparaison des dépenses en pourcentage des revenus permet une comparaison significative dans le temps, entre des pratiques de différentes tailles et situées dans différentes régions du pays. Par exemple, un établissement plus grand, générant plus de revenus, aura invariablement un total de dépenses en dollars plus élevé qu’un établissement plus petit qui génère moins de revenus. En exprimant les dépenses en pourcentage des revenus générés, il devient possible d’évaluer l’efficacité par rapport aux valeurs de références.

Bien que les résultats pour les paramètres financiers des établissements vétérinaires pour animaux de compagnie soient réjouissants, les résultats pour les paramètres concernant les clients ont une fois de plus montré très peu de changement positif. Le nombre de clients actuels a diminué de 1,4 % en 2019, s’établissant à 816 par médecin vétérinaire ETP, tandis que le nombre de nouveaux clients est resté essentiellement stagnant.
raise their fees each year, and diligently manage their expenses. Obviously, these are easier said than done, yet they are all possible to accomplish.

Pre-booking routine appointments and implementing Wellness Plans continue to show great impact in both retaining clients and increasing compliance. New clients are most effectively recruited by providing great service to current clients, who then recommend their veterinarian to friends and family.

Regular and attentive budgeting commonly proves the best method for keeping expenses under control, by identifying abnormal spending early and rectifying it before it evolves into a more serious concern. Implementing all these strategies can help a hospital’s net income expand for years to come.

Mixed and large animal hospitals

Mixed and large animal hospitals across Canada were not able to match the revenue growth of their companion animal colleagues, with the national weighted average climbing by 2.4%, to $544 425 per FTE DVM in 2019 (Figure 4). Echoing to $544 to $544 425 per FTE DVM in 2019, so a variation of 0.9% per rapport à 2018 (figure 3).

Dans l’ensemble, les paramètres financiers et relatifs aux clients indiquent que le médecin vétérinaire canadien moyen en pratique des animaux de compagnie voit moins de clients qu’il y a quelques années, mais cette baisse est compensée par l’augmentation des frais, l’amélioration de l’observance et la hausse du montant dépensé par chaque propriétaire d’animal. Ce scénario a bien fonctionné au cours des dernières années, comme le montrent les chiffres précédents, mais il sera éventuellement nécessaire de freiner la diminution du nombre de clients, en particulier si l’économie canadienne connaît un ralentissement et que les clients restreignent leurs dépenses.

Dans un monde idéal, un établissement vétérinaire conserverait tous ses clients actuels, attirerait beaucoup de nouveaux clients pour remplacer l’attrition naturelle, verrait une amélioration constante de l’observance, augmenterait ses frais chaque année et gérerait ses dépenses avec diligence. Évidemment, cela est plus facile à dire qu’à faire, mais cela demeure possible.

La prise de rendez-vous de routine d’avance et la mise en œuvre de plans de soins préventifs continuent d’avoir un impact important à la fois sur la fidélisation des clients et l’augmentation de l’observance. Les nouveaux clients sont plus efficacement recrutés en fournissant un excellent service aux clients actuels, qui recommandent ensuite leur médecin vétérinaire aux membres de leur famille et à leurs amis.

Une budgétisation régulière et attentive s’avère généralement la meilleure méthode pour maîtriser les dépenses, car elle permet de détecter rapidement les dépenses anormales et de rectifier le tir avant qu’elles ne deviennent une préoccupation plus sérieuse. La mise en œuvre de toutes ces stratégies peut aider à faire augmenter le revenu net d’un établissement vétérinaire pour les années à venir.

Grands animaux et pratiques mixtes

Les pratiques mixtes et des grands animaux au Canada n’ont pas pu égaler la croissance des revenus de leurs collègues du secteur des animaux de compagnie, la moyenne nationale...
previous years, mixed and large animal veterinarians are assiduous budgeters, and managed to limit expense growth to only 0.6%. This resulted in net incomes increasing faster than companion animal hospitals, expanding by 5.9% to a national weighted average of $193 041 per FTE DVM. Whereas 5 years ago, mixed and large animal hospitals had an average net income per FTE DVM that was over $21 000 lower than the companion animal hospital average; in 2019 this gap had narrowed to only approximately $7000.

As in companion animal hospitals, there were some provinces that outperformed the average. Alberta and Saskatchewan enjoyed revenue and net income gains beyond the national average, while British Columbia saw both metrics turn negative.

After bucking the recent trend and ticking slightly upwards in 2018, mixed and large animal hospitals got back on pace with non-DVM expenses, reducing them to 64.3% of gross revenue. This is a substantial decline from the high of 69.4% in 2015 (Figure 5).

While companion animal veterinarians appeared to focus more of their attention on expanding revenues in 2019, mixed and large animal veterinarians clearly directed their efforts to controlling expenses as a method for growing their net incomes.

On the heels of 4 years of solid growth, one of the greatest risks is that of complacency, particularly as many economists warn of a coming slowdown or recession. When a hospital is busy, it is easy to justify not implementing Wellness Plans, skipping budgeting, or even forgetting to raise fees, as there is enough business coming through the doors to make these feel unnecessary. Eventually though, this current expansion will cease; better to be well-prepared ahead of time.

Notes: Data for the CVMA Practice Owners Economic Survey are derived from the 2019 Provincial Practice Owner’s Economic Surveys. Provincial averages are weighted based on relative population size to calculate a national weighted average for all metrics. For the purposes of this research, a Full-Time Equivalent veterinarian is assumed to work 1750 hours annually. Note that, due to data gaps in 2015, Quebec is omitted from the calculation of the national averages for all years presented.
History and clinical signs

A 4-year-old spayed female Labrador retriever cross dog was referred to the ophthalmology service at the Western College of Veterinary Medicine (WCVM) for evaluation of a chronic superficial corneal ulcer affecting the right eye for the past 14 days. The menace responses, and palpebral, oculocephalic, direct, and consensual pupillary light reflexes were present bilaterally. Schirmer tear test (Schirmer Tear Test Strips; Alcon Canada, Mississauga, Ontario) values were 27 and 17 mm/min in the right and left eyes, respectively. The intraocular pressures were estimated with a rebound tonometer (Tonvert; Tiolat, Helsinki, Finland) and were 11 and 13 mmHg in the right and left eye, respectively. Fluorescein staining (Fluorets; Bausch & Lomb Canada, Markham, Ontario) was positive in the right eye and negative in the left eye. The pupils were dilated with 0.5% tropicamide (Mydriacyl; Alcon Canada, Mississauga, Ontario) and biomicroscopic examination (Osram 64222; Carl Zeiss Canada, Don Mills, Ontario) and indirect ophthalmoscopic (Heine Omega 200; Heine Instruments Canada, Kitchener, Ontario) examinations were completed bilaterally. Biomicroscopic and indirect ophthalmoscopy were normal in the left eye. Biomicroscopic examination of the right globe revealed moderate blepharospasm, conjunctival hyperemia, and a superficial corneal ulcer affecting the paracentral cornea at the 11:00 position with corneal edema and non-adherent epithelium surrounding the ulcer. Biomicroscopic examination of the right upper eyelid revealed 2 ectopic cilia protruding through the palpebral conjunctiva. Indirect ophthalmoscopy was within normal limits for the right eye. Photographs are provided for your assessment (Figures 1A, B).

What are your clinical diagnosis, differential diagnoses, therapeutic plan, and prognosis?

Discussion

The ophthalmic diagnoses were ectopic cilia in the right upper eyelid and a secondary chronic superficial corneal ulcer affecting the right cornea. In the clinical photographs the hairs within the eyelid are evident (Figure 1B) and the secondary superficial ulcer with corneal edema and a ring of non-adherent epithelium surrounding the ulcer can be seen (Figure 1B). Resection of the ectopic cilia with an operating microscope was recommended and was performed the following day. Upon re-evaluation in 10 days the dog was comfortable, there was no evidence of aberrant cilia, and the corneal ulcer had healed.

Ectopic cilia develop from undifferentiated gland tissue due to dysplasia of the meibomian (i.e., tarsal) glands (1). They usually arise singly or with 2 or more hairs from the meibomian glands, although occasionally a nest of cilia may be present (2). The follicle itself is located 4 to 6 mm behind the lid margin of

Figure 1. Photographs of the right eye (A) and upper eyelid (B) of a 4-year-old Labrador retriever cross dog.

Department of Small Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Saskatchewan S7N 5B4.

Use of this article is limited to a single copy for personal study. Anyone interested in obtaining reprints should contact the CVMA office (hbroughton@cvma-acmv.org) for additional copies or permission to use this material elsewhere.
The lid near the base of the meibomian gland. Unlike distichia, which arise through the meibomian duct openings at the free lid margin, ectopic cilia emerge through the palpebral conjunctiva approximately 4 to 5 mm from the lid free margin and rub directly on the cornea, causing severe corneal irritation with or without ulceration. The ectopic hairs are usually the same color as the rest of the hairs of the dog and are located in a small, pigmented spot of palpebral conjunctiva. Breeds predisposed to ectopic cilia are flat-coated retriever, Pekingese, Shih Tzu, Cavalier King Charles spaniel, boxer, English bulldog, poodle, and Jack Russell terrier. Both lids can be affected but the upper eyelid is primarily involved. The condition is usually in the young dog, accompanied by acute, intense blepharospasm, and lacrimation; similar clinical signs to a conjunctival or corneal foreign body. The hair can easily result in a superficial corneal ulcer which, with chronicity, can be accompanied by corneal blood vessels (3).

The diagnosis of ectopic cilia requires sufficient cooperation of the patient, and light and magnification. Aberrant cilia are often overlooked and consequently misdiagnosed because the lid margin must be everted to observe the conjunctival surface. Magnification (5 to 10×) is critical to visualize the very short cilium. If an ulcer is present, the clock hour position of the corneal ulcer usually reveals the position of the cilia in the corresponding palpebral conjunctiva. A small pigmented or raised spot is often present where the hair(s) emerge (2). Biomicroscopic examination by a veterinary ophthalmologist is often helpful in confirming the diagnosis as occasionally the hairs can be depigmented and difficult to see. If ectopic cilia are suspected, referral is recommended to confirm the diagnosis and discuss treatment options for the cilia. Treatment reported for ectopic cilia include destroying the cilia follicles with cautery or cryotherapy, or complete surgical excision (3). Complete surgical excision of the hair and associated hair follicle/meibomian gland using the operating microscope is the treatment of choice as this ensures complete follicle resection with no possibility for regrowth of those cilia. The prognosis is favorable; however, the owner should be informed that other adjacent hairs may not be evident at the time of resection but that aberrant follicles may still be present that can give rise to hairs later necessitating resection (4).

In this case the ulcer present was superficial, chronic, non-healing and reminiscent of an indolent ulcer [i.e., boxer ulcer; spontaneous chronic corneal epithelial defect (SCCED)]. True indolent ulcers are spontaneous superficial ulcers of idiopathic etiology that typically occur in older dogs (5). Given that this patient was younger, age and signalment of the patient should drive the practitioner to look for a possible underlying etiology of the ulcer. The recommended treatment for idiopathic indolent ulcers/SCCEDs is cotton swab (Q-tip) debridement with or without a grid keratotomy or diamond burr debridement (6). Performing such procedures on this ulcer would be contraindicated as it could easily make the ulcer worse. It is, therefore, essential that all cases of non-healing ulcers be examined systematically and thoroughly to ensure that no underlying etiology causing chronic corneal ulceration can be identified before performing any additional procedures (i.e., grid keratotomy).

As it is very easy to overlook aberrant cilia as the cause of a non-healing ulcer, referral for biomicroscopic examination by an ophthalmologist is often helpful and is recommended with chronic corneal ulceration to help obtain an accurate diagnosis and allow for treatment in an efficient and appropriate manner.

References
Classifieds  Petites annonces

Business Directory  Annuaire des entreprises

Douglas C. Jack
Partner | VetLaw™

P 416.367.6389  |  TF 800.563.2595
F 416.367.6749  |  dcjack@blg.com

Consider selling your practice?
Consider VetCare—a Canadian Practice Acquirer.

Amy Ma
Business Development Manager

604-363-0972  1-855-838-7888
amy@vet-care.ca

Visit us online at:
www.vet-care.ca

Pawpals®
Paw Print Keepsake
TIME IS MONEY!
Save time with this one step, instant and easy to use pawprint memento kit.
orders@pawpalorders.ca
www.pawpalorders.ca
NO KNEADING • NO MIXING • NO BAKING • NO DRYING

Simmons Veterinary Practice Sales and Valuations
Trust advisors since 1977
Practice Sales • Practice Valuations • Buyer Agency
Sale Facilitation • Exit Strategy
Experience Representing Practice Owners Selling to Corporations
Elizabeth Bellavance DVM MBA CEPA
Canada@simmonsinc.com l 519-383-4438 l www.simmonsinc.com

KP Marker Plus
The KP Marker is essential for writing on slides, tubes, and other small vials.
These unique markers are long lasting, no smudging, ultra fine tipped and comes in a box of 12.

Contact your purchasing group for ordering information

Canadian Integrated Supplier of Veterinary Equipment & Digital Radiography Solutions
227G Brunswick Blvd.
Pointe-Claire, Quebec
1-877-440-4494
csr@uxr.ca

UXR
Digital & Dental X-Ray
Underwater Treadmills
Infusion Pumps/Monitors
Cages & Cat Condos
Assist Loop – Anti-inflammation
Centrifuges
Sterilization
Lighting/Tables/
Treatment Rooms

VetAdvice.com
TERRY A. JACKSON, CPA Inc.
CHARTERED PROFESSIONAL ACCOUNTANT

All About Veterinarians
Consulting, Coaching, Valuations, Negotiations, Purchase / Sale
Terry A. Jackson, CPA, CGA
Nika Dorofeyeva, CPA, CA
Phone: 604.939.2323  info@jandacga.com
Business Directory  Annuaire des entreprises

NEW WEBSITE WITH ONLINE ORDERING
www.chironcompounding.com

The flexibility you need, the quality you trust!

#3-503 Imperial Road N., Guelph, ON, N1H 6T9
PH: 519-824-7887 | 1-800-446-8689
Fax: 1-888-677-0437

100% Canadian Owned and Operated

Portable Oxygen for Pets
Administer life saving oxygen at home, in hospital, and in transport.

Features

- Provides 10L of Oxygen USP per canister.
- 3 Regulator flow rates: 0.5, 1.0 and 2.0 LPM.
- Cost effective, safe, easy to use, and 100% recyclable.
- Stock at the clinic or send a prescription to us and we will ship to your client.

ASK US About Our Starter Kit for CVMA Readers!

Stable-Table Mat
An exam table mat that lasts.

Features

- Provides surface grip for patients
- Reduces stress and anxiety
- Durable and highly tear resistant
- Non-skid padded bottom
- Easy to clean
- Anti-microbial

Available in over 15 designs or customize with your logo.

Receive 10% OFF with Promo Code CVMA10

POST YOUR CLASSIFIED AD ONLINE!

We are pleased to announce that with the revised website for the CVMA, www.canadianveterinarians.net classified advertising can now be fully submitted electronically and will be posted online within one business day after confirmation of payment.

Rates for advertisements will now be determined by the number of characters in the ad. (150 characters is approximately 25 words) and the full rate of insertion will be calculated automatically. Note that there is no charge for including contact information, such as name, address, phone, fax and e-mail, as this information is not calculated in the character count. All ads that are posted online as of the 4th of the month will appear in the following month's issue of The Canadian Veterinary Journal.

Payment by Visa or MasterCard is required before an advertisement is posted online. Ads will be posted within one business day of confirmation of payment and listed for 30 days from date of posting. The full rate of insertion will be charged even if the advertisement is cancelled prior to the expiration date. You will be notified by e-mail 48 hours prior to the expiration date of your advertisement so that you may renew it if desired. Failure to respond to the notification will result in the automatic removal of your advertisement upon expiry.

RATES FOR CLASSIFIED ADVERTISING

<table>
<thead>
<tr>
<th>Character Count</th>
<th>Member/Student Price</th>
<th>Non-Member Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 175 Characters</td>
<td>$36</td>
<td>$72</td>
</tr>
<tr>
<td>176–350 Characters</td>
<td>$54</td>
<td>$104</td>
</tr>
<tr>
<td>351–550 Characters</td>
<td>$68</td>
<td>$136</td>
</tr>
<tr>
<td>551–725 Characters</td>
<td>$84</td>
<td>$168</td>
</tr>
<tr>
<td>726–900 Characters</td>
<td>$103</td>
<td>$206</td>
</tr>
<tr>
<td>901–1075 Characters</td>
<td>$117</td>
<td>$234</td>
</tr>
<tr>
<td>1076–1400 Characters</td>
<td>$140</td>
<td>$280</td>
</tr>
<tr>
<td>Confidential Box Number</td>
<td>$6</td>
<td>$12</td>
</tr>
</tbody>
</table>

For further information, contact:
Laima Laffitte
Consultant, Advertising and Sponsorship
The Canadian Veterinary Journal
Tel: (613) 673-2659; Fax: (613) 673-2462; E-mail: laffitte.on@sympatico.ca

MADe IN CANADA
100% response in Double Blind Trials. See the results on www.lebalab.com

Cleans Teeth with the Ease of a Spray

THE LEBA III DIFFERENCE

LEBA III works with the saliva. No brushing required. Spray in the mouth, not on the teeth. Used daily, it stimulates good flora and combats bad bacteria keeping the teeth clean and the gums healthy.

Pets ingest dental products, they cannot rinse. They can become subject to the side effects of the chemical components. LEBA III contains no Grapefruit Seed Extract, no chlorides or chemical agents.

Used by veterinarians since 1994.

Email: tellus@lebalab.com Office tel: 1-519-542-4236

To contact us, call toll free: 1-866-532-2522

LebaLab Inc.
For long-term flea and tick protection...

**BRAVECTO®** is a **perfect match**, made to last!

Help support high quality care by recommending a flea and tick control product that **encourages compliance and minimizes potential gaps in protection.**

**Promote client satisfaction** by giving pet parents the **12-WEEK dosing interval** they prefer!

**Easy to love…and hard to forget!**

For more information, contact your Merck Animal Health representative, or Customer Service at 1 866 683-7838.

© 2019 Intervet Canada Corp. All rights reserved.


**BRAVECTO®** is a registered trademark of Intervet International B.V. Used under licence.

**SMART PROTECTION MADE EASY®** is a registered trademark of Intervet International B.V. Used under licence.

**MERCK®** is a registered trademark of Merck Canada Inc.

CA-BRV-191100005