Use of canine sourced platelet-rich plasma in a feline contaminated cutaneous wound

Repair of an acquired diaphragmatic hernia with surgical mesh in a foal

Perioperative analgesic use by Ontario veterinarians, 2012

Comparative efficacy of oral meloxicam and phenylbutazone in 2 experimental pain models in the horse

Epidemiological study of dogs with otitis externa in Cape Breton, Nova Scotia

Effect of pre-warming on perioperative hypothermia and anesthetic recovery in small breed dogs undergoing ovariohysterectomy

Computed tomographic measurement of canine urine concentration

Prevalence of Maedi-visna in Saskatchewan sheep

An unusual case of peripheral vestibular disease in a cat following ear cleaning
KNOWING MAKES ALL THE DIFFERENCE
An early diagnosis could save my life.

You can be the difference between “I wish we could have done something” and “I’m so glad we caught this soon enough…”

Visit IDEXX.ca/preventivecare to learn more
The cold days and nights of winter have a way of bringing old friends even closer together...

...and this winter is no exception

So it is with great excitement that Petcard, a supporter of the Canadian Veterinary Medical Association for 20 years, is proud to announce their new and exclusive partnership - the CVMA Petcard Program!*

As of March 1st, Petcard will offer exclusive benefits to all CVMA Members. Enroll now to:

• Receive a Gift Card for every loan for 3 months!
• Learn more about all of your exclusive benefits, including monetary rewards

Call 1-888-689-9876 or email us at info@petcard.ca

PETCARD AND THE CVMA - WARMING UP WINTER TOGETHER!

* The CVMA Petcard Program and its exclusive benefits are available only to Canadian veterinary practices owned in whole or in part by current CVMA members.
Purina® Pro Plan Veterinary Diets®
EN Gastroenteric Low Fat™ Dry Canine Formula

Introducing a formula with the lowest fat (g/100 kcal) of any dry GI-focused, canine therapeutic diet on the market†, formulated to nutritionally manage patients when fat digestion is compromised. For patients with pancreatitis, hyperlipidemia and lymphangiectasia, a low-fat diet can make a world of difference.

Learn more at www.ProPlanVeterinaryDiets.ca

† Comparison based on values published in PPVD Product Guide 2015 (average nutrient content), Hill’s Key 2016 (average nutrient contents), Royal Canin Product Guide 2016 (typical analysis).

Purina trademarks are owned by Société des Produits Nestlé S.A.
Contents  Table des matières

SCIENTIFIC RUBRIQUE SCIENTIFIQUE

CASE REPORTS  RAPPORTS DE CAS

141 Use of canine sourced platelet-rich plasma in a feline contaminated cutaneous wound
Francesco Gemignani, Anna Perazzi, Ilaria lacobetti

145 Repair of an acquired diaphragmatic hernia with surgical mesh in a foal
Cheryl R. Kolus, Jennifer M. MacLeay, Eileen S. Hackett

ARTICLES

149 Perioperative analgesic use by Ontario veterinarians, 2012
Jessica Reimann, Cate Dewey, Shane W. Bateman, Carolyn Kerr, Ron Johnson

157 Comparative efficacy of oral meloxicam and phenylbutazone in 2 experimental pain models in the horse
UCVM Class of 2016,* Heidi Banse, Alastair E. Cribb

168 Epidemiological study of dogs with otitis externa in Cape Breton, Nova Scotia
Laura R. Perry, Bernard MacLennan, Rebecca Korven, Timothy A. Rawlings

175 Effect of pre-warming on perioperative hypothermia and anesthetic recovery in small breed dogs undergoing ovariohysterectomy
Turi K. Aarnes, Richard M. Bednarski, Phillip Lerce, John A.E. Hubbell

BRIEF COMMUNICATIONS  COMMUNICATION BRÈVES

180 Computed tomographic measurement of canine urine concentration
Allison L. Zwingenberger, Danielle D. Carrade Holt

183 Prevalence of Maedi-visna in Saskatchewan sheep
Rhonda Heinrichs, Wendy Wilkins, Gordon Schroeder, John Campbell

STUDENT PAPER  COMMUNICATION ÉTUDIANTE

187 An unusual case of peripheral vestibular disease in a cat following ear cleaning
Sangsoo Daniel Kim

QUIZ CORNER  TEST ÉCLAIR

121
A GI Diet For Every Pet

- Promotes a strong immune system
- Commonly recommended for diarrhea associated with stress, antibiotic therapy, diet change and microflora imbalance

† Based on dollar and unit sales of Purina® Pro Plan Veterinary Diets® FortiFlora® as a percentage of total canine probiotic sales as reported by Impact Vet Inc, Division of Ag Data Ltd., 52 w/e 12/31/2015

For further information, visit www.ProPlanVeterinaryDiets.ca or call us at 1-866-884-VETS (8387).

Purina trademarks are owned by Société des Produits Nestlé S.A. Any other marks are property of their respective owners.
## Contents  Table des matières

### FEATURES  RUBRIQUES SPÉCIALES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Language</th>
<th>Authors</th>
</tr>
</thead>
</table>
| 113  | The Canadian Veterinary Journal  
La Revue vétérinaire canadienne | English  
French | Carlton Gyles |
| 117  | VETERINARY MEDICAL ETHICS  
DÉONTOLOGIE VÉTÉRINAIRE |  |  |
| 125  | WHAT CAN'T BE TAUGHT  
CE QUI NE S'ENSEIGNE PAS |  |  |
| 131  | The path to success  
Dr. Heather Gunn-McQuillan |  |  |
| 191  | THE ART OF PRIVATE  
VETERINARY PRACTICE  
L'ART DE LA PRATIQUE  
VÉTÉRINAIRE PRIVÉE |  |  |
| 193  | Retro communication  
Myrna Milani |  |  |
| 195  | VETERINARY DENTISTRY  
DENTISTERIE VÉTÉRINAIRE |  |  |
| 199  | Oral Surgery: Treatment of a dentigerous cyst in a dog  
Dr. Graham Thatcher |  |  |

### NOTICES  ANNONCES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Language</th>
<th>Authors</th>
</tr>
</thead>
</table>
| 189  | Index of Advertisers  
Index des annonceurs |  |  |
| 200  | Classifieds  
Petites annonces |  |  |
| 125  | NEWS  
NOUVELLES |  |  |
|  |  |  | Heather Broughton, Isabelle Vallières |

---

**Contributors**

"Instructions for authors" are available online  
(www.canadianveterinarians.net).  
Les «Directives à l'intention des auteurs» sont disponibles en ligne  
(www.veterinairesaucanada.net).
Introducing a new generation critical care blood gas analyzer that combines the revolutionary micro-electronics of the consumer world with Nova Biomedical’s innovative MicroSensor Card™ technology for a simpler, smaller, faster, and less expensive analyzer.

**10 Test Stat Menu**
PpH, PCO₂, PO₂
Na⁺, K⁺, Cl⁻, Ca²⁺
Glu, Lac, Hct

**ZERØ™ Maintenance Cartridge Technology**
16 day use life and replacement in half the time needed by other analyzers

**Automated, True Liquid QC**
On board liquid QC levels are coupled with continuous electronic self-monitoring (SQM)

**Clot Block™ Protection**
Unique probe and flow path protects the analyzer from blood clots

**Compact Size**
Height: 15.38 in (39.1 cm)
Width: 12.00 in (30.5 cm)
Depth: 14.35 in (36.2 cm)

MicroSensor Cartridge Card
2.5 in x 2 in (6.35 cm x 5.0 cm)
During a controlled, 3rd party scientific study, dogs were given StrixNB™ water additive in their daily drinking water. Between 56 and 84 days, the dogs showed a 25.4% REDUCTION IN CALCULUS. This was achieved with NO mechanical action.

We believe brushing is optimal when it comes to good oral care, but is not always performed on a daily basis. That’s why we offer a full range of easy to use, premium oral health products, allowing you to select the right options for a convenient oral health routine that works for your pet patient – StrixNB Toothpaste, StrixNB Water Additive (liquid and powder forms), and StrixNB Oral Spray.

A premium line of oral health products scientifically formulated using cutting-edge research into biofilms. For more information about carrying StrixNB, contact sales@strixnb.com

© 2017 Kane Biotech Inc. StrixNB™ is a trademark of Kane Biotech Inc. All rights reserved.
The beginning of a new year is a good time to look back on the past few years for The Canadian Veterinary Journal (The CVJ) and its service to Canadian veterinarians. Our goals have been to publish high quality scientific articles in clinical veterinary medicine and feature articles in areas of high interest, to promote transmission of scientific information of particular relevance to Canadian veterinarians, to provide a venue for Canadian veterinary researchers and writers, and to keep Canadian veterinarians abreast of professional activities. Feature articles call on current information in the literature and the experience of authors to address issues of clinical practice in the present. Case reports use similar approaches to bring information to practitioners. By contrast, many of our scientific research articles don’t present immediate solutions for today’s problems but represent investigation on the path to solutions in the future.

Many elements are involved in helping us to achieve our goals. An outstanding staff under the leadership of managing editor Heather Broughton at the CVMA office in Ottawa is a critical part of the production of the journal. Then there are numerous volunteers — 2 associate editors, 6 assistant editors, hundreds of writers, and hundreds of reviewers.

There are also challenges. One challenge is that we have little control over the articles that are submitted — we don’t control the extent to which various species are represented nor the extent to which various subjects are represented. Despite this we have species representation which appears to be reasonably balanced. However, in any given issue of the journal veterinarians practicing in one field may find that only a few articles address their specific interests. We are attempting to exert a little control by asking experts to write review articles on specific topics of interest to practitioners. These will differ from expert opinions in being evidence-based and having the evidence presented so both practitioners and specialists can evaluate.

We attract a large number of submissions to the journal, resulting in our having to reject about two-thirds of the articles.

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.
that are submitted. Our system of initial screening of articles followed by peer review of articles that survive the screening process appears to work well, but it is becoming increasingly difficult to obtain reviewers — likely because of increased work loads of veterinary researchers and clinicians in specialized practices who do most of the reviewing.

Another challenge we are addressing is the time between acceptance of an article and publishing it in the journal. At present this time is about 10 months, which is too long. Authors, understandably, want to have articles published in a very short time — and there are some journals that do this. For the most part, these are journals that charge authors a substantial fee (often around $3000), publish online only, and allow immediate free access to anyone with an online connection. The journals which do this are typically research oriented journals that depend on their authors having access to substantial research funds that pay for the publication. Clinical veterinary journals usually have a print format, depart from this “author-pay” model, and depend on advertising revenue to meet the costs of publication. This model has worked well for the _CVJ_ in the past. However, the economic downturn and consolidation in areas such as the pharmaceutical industry, have contributed to reduced advertising revenue. This has led to an inability to publish as many articles as we would like. This in turn has caused a backlog of accepted articles and a delay in publication. In response, we have instituted a small publication fee, we have obtained sponsorship for one of our regular features, and we are continuing to seek other revenue sources.

Another challenge is the need to respond to concerns about the impact factor for our journal. This is an important issue, which I will write about in my next editorial.

We communicate regularly with CVMA members to try to meet their expectations. These communications take the form of questionnaires, external analyses, and open discussions at meetings — these have been valuable in allowing an exchange of information. The CVMA Editorial Committee, chaired by Dr. Ron Lewis, is very active in seeking solutions to the challenges we meet and we are confident that we will find ways to make a very good journal even better.

_Carlton Gyles_
Leba III is on your side, tartar will tap out.

BLUEWATER BRIDGE, ON, CA & MI, USA
Photo by David J Sullivan

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

35 DAYS LATER
Before
After

28 DAYS LATER
Before
After

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.

To Order, Call 1 (866) 532-2522
Questions? Call 1 (519) 542-4236 | www.lebalab.com | tellus@lebalab.com
Introducing broad-spectrum tick species protection from Simparica™ (sarolaner chewable tablets)¹

Safe, monthly chewables for dogs that offer persistent protection from fleas and a broad spectrum of tick species.¹ Simparica acts fast — it starts killing fleas within 3 hours¹ and ticks within 8 hours* — and keeps going strong for 35 days²,³ without losing effectiveness at the end of the month.

*Studies show Simparica starts killing ticks in 8 hours and is ≥94.5% effective for 35 days against weekly reinfestations of Ixodes scapularis, Amblyomma americanum, Amblyomma maculatum, Dermacentor variabilis and Rhipicephalus sanguineus.²,³


Zoetis is a registered trademark and Simparica is a trademark of Zoetis or its licensors, used under license by Zoetis Canada Inc. ©2017 Zoetis Inc. All rights reserved. SIM-002
Ethical question of the month — February 2017

Several niche marketing programs forbid the use of antimicrobials in livestock production. This creates problems for producers and for the animals they care for. These niche marketing programs require that if an animal is treated with an antibiotic, it must be identified and removed from the niche marketing program. This creates an incentive for producers to “wait and see” if an animal can resolve an infection on its own. Regardless of the outcome, there is unnecessary suffering associated with the delay in treatment. This violates both the husbandry ethic as well as public expectations. If the stockperson eventually treats the animal, it seldom responds as well as it would have if the treatment has been given in a timely manner. Individual animals treated with an antimicrobial can be difficult to market. Irregular marketing of treated animals is time-consuming and often less profitable. As a result, “no antibiotic” marketing schemes have the potential to create negative effects on animal welfare. Can veterinarians be associated with no antibiotic niche programs and still adhere to their oath to prevent unnecessary animal suffering?

Question de déontologie du mois — Février 2017

Plusieurs programmes de marketing de créneau interdisent l’utilisation des antimicrobiens dans la production du bétail. Cela crée des problèmes pour les producteurs et les animaux dont ils s’occupent. Ces programmes de marketing de créneau exigent que, si un animal est traité à l’aide d’un antibiotique, il doit être identifié et retiré du programme de marketing de créneau. Cette situation incite les producteurs à attendre pour voir si un animal peut vaincre l’infection par lui-même. Sans égard au résultat, il se produit des souffrances inutiles lorsque l’on tarde le début du traitement, ce qui est contraire à l’éthique d’élevage ainsi qu’aux attentes du public. Si le préposé au bétail traite finalement l’animal, il répond rarement aussi bien que si le traitement avait été administré plus rapidement. Les animaux individuels traités à l’aide d’un antimicrobien peuvent être difficiles à commercialiser. La commercialisation irrégulière des animaux traités est longue et souvent moins rentable. Par conséquent, les programmes de commercialisation «sans antibiotiques» ont le potentiel d’avoir des effets négatifs sur le bien-être animal. Les vétérinaires peuvent-ils être associés à des programmes de créneau sans antibiotiques et toujours respecter leur serment de prévenir les souffrances inutiles des animaux?

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.

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 vos nom et adresse à l’adresse suivante : Choix déontologiques, a/s du D’ 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.
Ethical question of the month — November 2016

A veterinarian who recently joined your 4-person small animal practice is engaged in a discussion with a long-time client over euthanizing her 16-year-old cat. The cat has been losing weight (although the owner reports a normal appetite) over the last several months due to kidney failure. The cat responded moderately well to the interventions applied but is not expected to recover. Your new colleague believes it is time to euthanize the cat. The owner wishes to give the cat more time. The veterinarian emphasizes his responsibility to avoid unnecessary suffering and mentions his professional obligation to call in the humane society in cases in which owners allow their pets to suffer unnecessarily. The owner is shocked that the veterinarian would accuse her of treating her long-time companion inhumanely. She is certain that after 16 years with this animal that she is a better judge of its comfort and well-being than a veterinarian who has spent 15 minutes examining the cat and associated lab reports. You feel that you should intervene. **How should you respond?**

Submitted by Linda Chow, Ottawa, Ontario.

Question de déontologie du mois — Novembre 2016

Un vétérinaire qui s’est récemment joint à votre pratique pour petits animaux de quatre personnes discute avec un client de longue date à propos de l’euthanasie de son chat âgé de 16 ans. Le chat a perdu du poids (mais la propriétaire signale que le chat a un appétit normal) au cours des derniers mois en raison d’une insuffisance rénale. Le chat a réagi modérément bien aux interventions effectuées, mais on ne s’attend pas à un rétablissement. Votre nouveau collègue croit qu’il est temps d’euthanasier le chat. La propriétaire désire donner plus de temps au chat. Le vétérinaire insiste sur la responsabilité de la propriétaire à éviter des souffrances inutiles et mentionne son obligation professionnelle de contacter la société de protection des animaux dans les cas où les propriétaires laissent les animaux souffrir inutilement. La propriétaire est scandalisée que le vétérinaire l’accuse de traiter avec cruauté son compagnon de longue date. Elle est convaincue que, après 16 ans auprès de cet animal, elle est meilleure juge de son confort et de son bien-être qu’un vétérinaire qui a passé 15 minutes à examiner le chat et à consulter des rapports de laboratoire. Vous estimez que vous devriez intervenir. **Comment devriez-vous réagir?**

Soumise par Linda Chow, Ottawa (Ontario)

Veterinarian displays great insensitivity to client — A comment

Essential information left out of the scenario is the cat owner’s relationship with the veterinary practice prior to her being assigned to the recently added veterinarian, in particular how long the now 16-year-old cat has been a patient in the practice. Ostensibly she has been satisfied for a considerable time with the treatment she and her cat have been accorded. Why she and her cat have been assigned to the new veterinarian is likewise questionable.

That said, the cat owner’s reaction to the new veterinarian’s callous and unempathetic attitude and behavior is understandable and justified. Her feelings and assessment of her cat’s status are most likely correct (especially given no evidence to the contrary).

No matter whether the practice’s recent addition is a newly minted practitioner or a seasoned veteran, such behavior should not be countenanced on any level; it is an affront to the pet owner and casts the practice’s ethics in a bad light. Such issues should be brought to the individual’s attention for remediation. If he/she is unwilling to modify his/her approach in dealing with the cat owner, the latter should be referred to a more sympathetic and conscientious member of the practice.

John B. Delack, PhD, DVM, Saskatoon Saskatchewan

An ethicist’s commentary on a veterinarian displays great insensitivity to client

However knowledgeable and technically skilled this new veterinarian is, he or she is significantly lacking both in common sense and common decency. The client is altogether correct in objecting to how the veterinarian has approached her. He/she has absolutely no place second-guessing the client who has lived in close contact with the cat for 16 years. One well-established way of detecting pain in an animal is to pay attention to deviations in behavior, food intake, demeanor, and even personality exhibited by the animal. The veterinarian who has examined the cat for 15 minutes has no background knowledge to compare with what he sees in this brief period. The sensitive client on the other hand, however medically uneducated he or she may be, very likely possesses an acute awareness of variation in how the cat behaves.

Far more egregious, indeed downright offensive, is his invoking the threat of reporting the owner to the Humane Society. That threat, expressed in the context described in this case, bespeaks a remarkable degree of insensitivity that merges into stupidity. If I were the client, I would say goodbye to the veterinarian and never return.
As I have said before in this column, when clients praise a veterinarian to others as being “an excellent veterinarian” virtually none of them have studied the rates of cure achieved by this practitioner, his or her medical knowledge, the number of publications he or she has on diverse topics, or any other modality medically justifying such a claim. What they are really addressing is the degree of what is known in Yiddish and German as menschlichkeit, human decency, the veterinarian displays. Unfortunately possession of this trait does not enjoy a high correlation with technical proficiency. People are referring to the concern the practitioner shows, the empathy he or she displays, the degree of identification with you and the animal that shines through in the course of the visit. This is a major part of what is meant when people talk about medicine, human or veterinary, as much art as science. The old cliché is operative here — “people do not care about how much you know, until they know how much you care.”

I am reminded of a veterinarian at Colorado State University in the 1970s who was a pioneer in developing procedures for treating osteosarcoma in dogs. My beloved Great Dane was treated by him, which treatment was quite invasive and at one point required a fore-limb amputation. She was always delighted to see him and they developed a bond beyond the medical and scientific. He was a tough man from a cowboy background. On the day when her disease had progressed to the point that euthanasia was necessary, and he injected her with the solution, I saw a tear roll down his cheek. He was very embarrassed, and apologized profusely, and yet because of that incident he will forever have a place in my heart.

I have serious doubts that any amount of training can rectify the degree of insensitivity displayed by the veterinarian in this case. But it is worth a try. Perhaps we cannot create sensitivity to the simple fact that what one says and how one says it can create great hurt in clients. But we can at least hope that he can learn to check his insensitivity. Without such sensitivity, the veterinarian will never be able to successfully deploy the Aesculapean authority essential to good medicine.

Bernard E. Rollin, PhD

Have Another Look at CJVR
Avez-vous consulté la RCRV dernièrement?

Members of the CVMA are entitled to receive the Canadian Journal of Veterinary Research (CJVR) at no additional charge. The CJVR, in the form of an interactive (portable document format) pdf, can be found on the CVMA member-only website (www.canadianveterinarians.net/publications-research-issue.aspx).

Published by the CVMA, this quarterly, peer-reviewed journal is Canada’s only national veterinary research publication.

Articles from the January 2017 issue of CJVR that might be of interest to practitioners include:

**Evaluation of the new commercial recombinant chimeric subunit vaccine PRRSFREE in challenge with heterologous types 1 and 2 porcine reproductive and respiratory syndrome virus** on page 12

**Association of gingivitis with dental calculus thickness or dental calculus coverage and subgingival bacteria in feline leukemia virus- and feline immunodeficiency virus-negative cats** on page 46

The CJVR, along with the monthly Canadian Veterinary Journal, is also archived on PubMed Central (www.pubmedcentral.com) 6 months after publication.

An interactive pdf of The CVJ is also available on the member-only section of the CVMA website.
THANK YOU
FROM
VETERINARIANS
WITHOUT BORDERS
CANADA-NORTH PROGRAM

Thanks to your contribution, we reached our goal of donating $30,000 to help the communities of Northern Canada.

The Veterinarians without Borders Canada-North program will provide veterinary health care and support for remote and underserviced Canadian communities.

www.vetswithoutborders.ca

THANK YOU
FROM
VETERINARIANS
WITHOUT BORDERS
CANADA-NORTH PROGRAM

Clavaseptin®
Amoxicillin/clavulanic acid chewable tablets

www.vetoquinol.ca
1. Collies and other herding breeds have a higher than usual incidence of toxicosis to which of the following antiparasitic agents?
   A. Melarsomine
   B. Pyrantel pamoate
   C. Ivermectin
   D. Imidocarb
   E. Fenbendazole

2. Which of the following is/are positive signs of successful placement of an epidural needle?
   1. Aspiration of a clear fluid.
   2. Moderate resistance to injection of saline.
   3. The "hanging drop" being sucked into the needle.
   4. Some crepitus being palpated after injection of a small amount of air.
   A. 1 is correct
   B. 1, 3, and 4 are correct
   C. 2, 3, and 4 are correct
   D. 3 is correct

3. Which of the following is true regarding FeLV?
   A. FeLV infection never results in a carrier state.
   B. Kittens younger than 4 months of age are most susceptible.
   C. FeLV survives for long periods in the environment and is resistant to disinfectants.
   D. Transplacental transmission does not occur.
   E. Regenerative anemia is common.

4. A horse that displays rhythmic or spasmodic grinding of the teeth, accompanied by loud grinding sounds, is exhibiting which of the following behaviors?
   A. Wind sucking
   B. Cribbing
   C. Bruxism
   D. Weaving

1. Le Colley et les autres races de chiens de troupeau possèdent une incidence plus grande que la normale à l’empoisonnement par lequel des agents antiparasitaires suivants?
   A. mélarosome;
   B. pamoate de pyrantel;
   C. ivermectine;
   D. imidocarbe;
   E. fenbendazole.

2. Lequel (lesquels) des critères suivants témoigne(nt) de façon positive du bon positionnement d’une aiguille épidurale?
   1. Aspiration d’un liquide clair
   2. Résistance modérée à l’injection d’une solution saline
   3. «Goutte suspendue» de liquide aspirée dans l’aiguille
   4. Palpation de crépitations après l’injection d’une petite quantité d’air
   A. 1 est correct;
   B. 1, 3 et 4 sont corrects;
   C. 2, 3 et 4 sont corrects;
   D. 3 est correct.

3. Lequel des énoncés suivants est vrai à propos du virus de la leucose féline (VLFe)?
   A. L’infection par le VLFe ne résulte jamais en un état de porteur.
   B. Les chatons âgés de moins de 4 mois sont les plus sensibles.
   C. Le VLFe survit durant de longues périodes de temps dans l’environnement et il est résistant aux désinfectants.
   D. La transmission transplacentaire ne se produit pas.
   E. L’anémie régénérative est commune.

4. Un cheval qui présente des grincements de dents rythmiques ou spasmodiques, accompagnés de bruits de grincement bruyants, manifeste lequel des comportements suivants?
   A. tic aérophagique;
   B. tic à l’appui;
   C. bruxisme;
   D. tic de l’ours.
5. Which of the following management practices is appropriate for the maternity pen on a dairy farm?
   A. Separation of calves from cows after suckling
   B. Ear tagging after grouping with other calves
   C. Animals remaining recumbent for 2 hours after parturition
   D. Orogastric intubation if calf feeding is incomplete
   E. Use of all available colostrum


(See p. 192 for answers. Voir les réponses à la page 192.)
NORTHEAST INDIANA VETERINARY EMERGENCY & SPECIALTY HOSPITAL

FOUNDED 1967 | LEGACY PRESERVED 1997

“NVA didn’t come in and redo our practice. For the nine years before we retired, we continued to practice the way we always had. Because of that, we were very comfortable.”

– Dr. David Thoma and Dr. Roy Coolman

Join us and we’ll preserve your legacy.

NVAonline.com/stayyou
888-767-7755
Be delighted.

Join like-minded peers at Canada’s only multi-species event. Get inspired by over 42 speakers and renew your passion for veterinary medicine.

REGISTRATION OPENS FEBRUARY 16!
Welcome to the Profession Future Veterinarians!

The Canadian Veterinary Medical Association (CVMA) supports all future veterinarians on their journey toward their new career, and every Canadian veterinary student is a full member of the CVMA. Each Canadian veterinary college hosts an annual lab coat ceremony in the fall. At these ceremonies, the CVMA presents 1st-year students entering the veterinary profession with a CVMA embroidered laboratory coat and personalized name badge. Please join us in welcoming these students; the future of the Canadian veterinary profession!

Ontario Veterinary College Class of 2020
Promotion 2020 de l’Ontario Veterinary College
The First Annual SCVMA Leadership Workshop

Première édition annuelle de l'Atelier de leadership étudiant des ÉACMV

I was honored and excited to learn I would be organizing the first Annual Students of the Canadian Veterinary Medical Association (SCVMA) Leadership Workshop at the University of Montreal’s Faculté de médecine vétérinaire (FMV) in Saint-Hyacinthe, Québec. I met Dr. Rick DeBowes at CVMA’s Annual Convention, while participating in the CVMA’s Emerging Leaders Program. After being amazed by his charisma and communications skills, I knew he would be the perfect choice to lead this pilot workshop and help FMV students gain new personal insight, refine their communications skills, and become better leaders in the veterinary community.

On November 12, 2016, Dr. DeBowes wowed almost 60 students participating in the SCVMA’s first SCVMA Leadership Workshop. The Workshop’s content and format did not resemble anything students would learn in FMV’s curriculum. Participants learned the necessary tools needed to be the best version of themselves and how they have the freedom and ability to make choices based on their values while practicing veterinary medicine. Participants learned more about the potential forces guiding their lives and that they should accept change, adjust perception, suspend judgement, and be open to all possibilities. Change can be difficult, especially in veterinary medicine, but participants will never forget Dr. DeBowes’ advice, “Remember that change is essential for progress to happen.” Dr. DeBowes shared his passion for leadership through discussions, exchanges, exercises and anecdotes; he inspired participants by making them believe they have the potential to change their approach to their personal and professional lives.

J’ai été honorée et excitée d’apprendre que j’organiserais la première édition annuelle de l’Atelier de leadership étudiant des ÉACMV à la Faculté de médecine vétérinaire (FMV) de l’Université de Montréal à Saint-Hyacinthe, au Québec. J’ai rencontré le Dr Rick DeBowes lors du congrès annuel de l’ACMV, pendant que je participais au Programme des futurs leaders de l’ACMV. Après avoir été agréablement surprise par son charisme et sa facilité à communiquer, je savais qu’il serait le choix idéal pour animer cet atelier pilote et aider les étudiants de la FMV à effectuer une réflexion personnelle approfondie, à peaufiner leurs aptitudes de communication et à devenir de meilleurs leaders au sein de la collectivité vétérinaire.

Le 12 novembre 2016, le Dr DeBowes a épaté près de 60 étudiants qui participaient au premier Atelier de leadership étudiant des ÉACMV. Le contenu et le format de cet atelier ne ressemblaient en rien aux apprentissages des étudiants contenus dans le curriculum de la FMV. Les participants y ont fait l’acquisition des outils nécessaires pour tirer le meilleur d’eux-mêmes et ils ont appris comment ils possèdent la liberté et la capacité de faire des choix basés sur leurs valeurs pendant l’exercice de la médecine vétérinaire. Les participants se sont renseignés sur les paradigmes qui guident leur vie et ils ont appris qu’ils doivent faire face au changement, ajuster leur perception, suspendre leur jugement et être ouverts à toutes les possibilités qui s’ouvrent à eux. Le changement peut être difficile, particulièrement en médecine vétérinaire, mais les participants se souviendront toujours du conseil du Dr DeBowes : «Rappelez-vous que le changement est essentiel pour faire place au progrès.» Le Dr DeBowes a partagé sa passion du leadership dans
It was a pleasure organizing this Workshop, experiencing participants’ gratitude for having the chance to partake and, best of all, it felt great offering this Workshop to students free of charge. This event offered complimentary registration and participants were served a free, delicious lunch thanks to our generous sponsors: Hill’s Prescription Diet and Virox Animal Health (who also had representatives onsite), HED Courtiers en assurance Inc., National Bank and Purina. Another special thank you goes out to the Canadian Veterinary Medical Association; without the constant support of student initiatives, events like this would not be possible. Also, thank you to Dr. DeBowes; we are so grateful that you agreed to lead this student Workshop. I'm not only speaking for myself when I say no other speaker could have done such a fantastic job.

The SCVMA Leadership Workshop will be held annually at one of the 5 Canadian veterinary colleges on a rotational basis. I urge students at the Ontario Veterinary College, hosting the 2017 Workshop, to take advantage of this rare opportunity to attend this workshop. The participants from FMV and I unanimously agree it was incredibly rewarding and inspiring!

Here is what some of the 2016 SCVMA Leadership Workshop participants had to say about their experience:

“I learned so much from Dr. DeBowes about who I am, what I can do to better myself and how I can make other people’s lives better. I am so grateful for having the chance to participate in this workshop.”

“This should be mandatory for all students. I would absolutely do this again given the chance.”

“It was a super experience. After leaving this Workshop, I have many new ways of seeing and thinking about things.”

“Wow, a really wonderful experience. Dr. DeBowes is excellent at explaining things in layman’s terms and he knows how to get you to see things for yourself.”

“This will be useful in my career as a veterinarian, but also in my life as a person.”

“Wow, this was an incredible Workshop and I am so happy to have participated. I am convinced this will make me a better veterinarian.”

(by Mélissa Gohier, SCVMA Senior FMV Representative, University of Montreal’s Faculty of Veterinary Medicine)
CVMA’s November Council Meeting Agenda

The CVMA Council, consisting of representatives from all provinces, veterinary students, veterinary colleges, and veterinary technicians met at the end of November with the primary objective to make policy decisions and approve the CVMA’s 2017 program plan and budget. Council appointed or reappointed a total of 87 committee member positions and 23 representatives with external agencies.

A fond farewell and warm appreciation for the many years served was given to 3 Council members whose terms were ending at the end of December 2016: Dr. Robert Ashburner (British Columbia), Dr. Kevin Millar (Manitoba) and Dr. Michele Guerin (OVC/WCVM/UCVM).

In 2015, the CVMA Council re-affirmed its “core-competencies” as Animal Welfare, National and International Issues, which are in line with the top-ranked value propositions to our members. In July 2017, Council reflected upon CVMA and the demands on veterinary services and hence the demands on services that the CVMA should provide. With millennials (generally defined as those aged 18–34) representing 36.8% of Canada’s workforce, it is critical, therefore, to understand their needs for the purpose of CVMA planning.

National and International Issues:

Dr. Siddika Mithani, president, Public Health Agency of Canada; Dr. Martine Dubuc, Canadian Food Inspection Agency (CFIA), vice-president, Science Branch, Chief Food Safety Officer, and World Organisation for Animal Health (OIE) delegate for Canada; Dr. Mary-Jane Ireland, director general, Veterinary Drugs Directorate (VDD), Health Canada, joined Council to discuss matters of pertinence to veterinarians, with an emphasis on the involvement of veterinarians in antimicrobial resistance.

“Veterinary Oversight of Antimicrobial Use — a Pan-Canadian Framework for Professional Standards for Veterinarians,” a document drafted by the CVMA in collaboration with the Canadian Council of Veterinary Registrars (CCVR)
was the center of discussions held with a broad stakeholder group during the 2016 CVMA Summit. The purpose of this document is to provide a template of professional standards to be used by provincial and territorial veterinary regulatory bodies when developing their own regulations, guidelines, or bylaws relating to the professional responsibilities of veterinarians in the use of antimicrobials. The final version of this document was provided to stakeholders in December 2016.

In 2017, the CVMA will continue its campaign Veterinary Oversight of Antimicrobial Use in Canada: Regulations are Changing… We Want You to Be Prepared! In 2016, the campaign provided information and messaging targeted specifically at veterinarians. For 2017, the CVMA foresees a coordinated effort with stakeholders to develop messaging targeting producer groups.

Also in 2017, the CVMA is planning to renew the 2008 food animal Antimicrobial Prudent Use Guidelines and continue with the development of online small animal guidelines.

The CVMA is currently working with the CFIA to develop surveys on the use of antimicrobials for food animals and companion animals. The CFIA will provide funding for this project.

The CVMA has been invited to participate with the Antimicrobial Stewardship Canada (AMSC), a group of human healthcare organizations, to identify connections and responses to AMR in human and animal medicine, and to collaborate in initiatives of mutual interest, such as coordinated messaging on AMR.

The CVMA has representation on the Advisory Board of the Canadian Global Food Animal Residue Avoidance Database (CgFARAD). Currently, the program works on a break-even budget. For this reason, a partial user-pay system is not being considered at this time.

The National Association of Pharmacy Regulatory Authorities (NAPRA) has provided the CCVR and the CVMA with a draft position on the role of pharmacists in providing pharmaceutical care to animals. The CVMA and the CCVR have provided responses and suggestions and will continue the dialogue.
**Importation des chiens au Canada :**

Le Conseil de l'ACMV a approuvé l'énoncé de position suivant :

« L'ACMV appuie l’importation des chiens au Canada seulement dans les cas où il existe des contrôles efficaces afin d’atténuer les risques de maladies infectieuses pour les Canadiens et les populations résidentes d’animaux. De plus, l’ACMV doit constater que des politiques sont mises en place afin de protéger le bien-être des animaux importés. L’ACMV encourage le gouvernement fédéral à jouer un rôle de leadership dans l’élaboration de politiques, de lois et de règlements ainsi que de stratégies de gestion des risques qui sont efficaces à l’échelle nationale. De plus, l’ACMV encourage l’élaboration et la mise en œuvre d’initiatives éducatives par les organisations d’intervenants afin d’informer leurs membres à propos des risques pour la santé animale, la santé publique et le bien-être animal ainsi que la mise sur pied de stratégies d’atténuation inhérentes à l’importation des chiens et au mouvement transfrontalier des chiens au Canada. »


**Bien-être animal :**

L’ACMV a préconisé la modernisation de la Loi sur la protection des animaux au Canada au cours de la majeure partie des vingt dernières années. Notre dernière tentative a été l’appui accordé au projet de loi C-246, un projet d’initiative parlementaire. Pendant l’été de 2016, l’ACMV a communiqué avec Nathaniel Erskine-Smith, le député fédéral qui appuyait le projet de loi, et a fourni des renseignements aux vétérinaires canadiens sur la façon dont ils pouvaient exercer des pressions auprès de leur propre député pour qu’il appuie ce projet de loi. Le projet de loi a été défait à la Chambre des...
“The Canadian Veterinary Medical Association (CVMA) is strongly opposed to the practice of cutting teeth in dogs. In addition, the CVMA opposes the reduction or removal of dogs’ teeth for non-medical reasons.”

Furthermore, Council directed that the current Position Statement on Ownership and Selection of a Pet be rescinded. This Position Statement has been replaced with Selecting and Owning a Pet web resources, which can be found in the Animal Owners section of the CVMA website, under the Public Resources tab.

Council amended and approved the revised position statement on Partial Digital Amputation (Onychectomy or Declawing) of the Domestic Felid:

“The Canadian Veterinary Medical Association (CVMA) opposes elective and non-therapeutic Partial Digital Amputation (PDA), commonly known as declawing or onychectomy, of domestic cats.”

Students of the CVMA:
The data from the New Graduate Survey of the class of 2015, with a 33% survey participation rate, revealed the following: 95.5% of participants have been working in the veterinary field since graduation; 73% secured their job before graduation; 83.5% were very satisfied or satisfied with their position. Depending on the college of graduation, the mean starting salaries were between $66 000 and $70 000; the mean school-related debt at graduation was between $19 000 and $101 000 (this figure also includes some international students graduating from a Canadian school).

The 2017 SCVMA Symposium will be held January 20–21 in Calgary, Alberta. The first ever SCVMA Leadership Workshop was held at the Faculté de médecine vétérinaire (FMV) in November and will be held in 2017 at the Ontario Veterinary College. Almost 60 students attended the workshop at FMV.

Membership:
CVMA Council is pleased that in 2016 membership increased 7.2% to 7287 members. Thank you to all who have chosen to be part of “One Profession, One Strong Voice”!

The CVMA continues expanding its Early Career DVM program; Mentorship program; “What Can’t Be Taught” CVJ articles; and the Web-based Early Career Resource Hub containing information relating to financial planning, budgeting, communications, and career development.

The CVMA will maintain its focus on Veterinarian Health and Wellness. A new “Veterinary Health and Wellness Resources” section on the website was recently established. The 2016 CVMA Convention also featured a full-day Mind-Body Medicine Workshop. The CVMA is considering its potential involvement in 2 wellness conferences planned by the Canadian Medical Association.

Communications:
The social media awareness campaign #VetCareEverywhere, which targets public audiences on Facebook and Twitter, will continue in 2017. Also, the tick awareness campaign will take place again in March. Based on sales statistics, the 2016 campaign appears to have been successful. The 2017 Animal Health Week will have an Animal Welfare theme.

“L’Association canadienne des médecins vétérinaires (ACMV) s’oppose à la pratique de couper les dents des chiens. De plus, l’ACMV s’oppose à la réduction ou à l’extraction des dents des chiens pour des raisons non médicales.”

De plus, le Conseil a demandé que l’énoncé de position actuel sur l’amputation partielle des doigts (onychectomie ou dégriffage) des félinés domestiques : « L’Association canadienne des médecins vétérinaires s’oppose à l’amputation partielle des doigts qui est non urgente et non thérapeutique et est communément appelée dégriffage ou onychectomie des chats domestiques. »

Étudiants de l’ACMV :
Les données du Sondage auprès des finissants de la promotion de 2015, qui a affiché un taux de participation de 33 %, a révélé les faits suivants : 95,5 % des participants travaillaient dans le domaine vétérinaire depuis l’obtention du diplôme ; 73 % avaient obtenu leur emploi avant la fin du cours ; 83,5 % étaient très satisfaits ou satisfaits de leur poste. Selon l’école d’obtention du diplôme, les salaires de départ moyens se situaient entre 66 000 $ et 70 000 $ ; la dette d’études moyenne au moment de l’obtention du diplôme s’établissait entre 19 000 $ et 101 000 $ (ce chiffre incluait aussi des étudiants internationaux qui obtenaient un diplôme dans une école canadienne).

Le Symposium 2017 des ÉACMV se tiendra les 20 et 21 janvier à Calgary, en Alberta. Le premier Atelier de leadership étudiant des ÉACMV s’est déroulé à la Faculté de médecine vétérinaire (FMV) en novembre et aura lieu en 2017 à l’Ontario Veterinary College. Près de 60 étudiants ont assisté à l’atelier tenu à la FMV.

Effectif :
Le Conseil de l’ACVM a le plaisir d’annoncer que l’effectif a connu une augmentation de 72 % en 2016, pour s’établir à 7287 membres. Merci à tous ceux et celles qui ont choisi de faire partie d’« Une profession, Une voix solidaire » !

L’ACVM continuera d’élargir son programme pour les vétérinaires en début de carrière ; de publier des articles « Ce qui ne s’enseigne pas » dans La RVC ; et d’afficher le Carrefour des ressources Web pour les vétérinaires en début de carrière portant sur la planification financière, la budgétisation, les communications et l’avancement de la carrière.

L’ACVM continuera aussi de se concentrer sur la santé et le bien-être des vétérinaires. Une nouvelle section des « Ressources pour la santé et le bien-être des vétérinaires » du site Web a
Reports show that pre-booking appointments is less expensive than the conventional ways of booking client appointments. The CVMA has raised awareness through an article published in the January 2017 issue of The CVJ. In addition, the CVMA is planning a 6-month campaign, promoting forward-booking in 2017.

Convention:
Approximately 1000 participants attended the 2016 CVMA Convention that offered over 100 sessions with a total of 37 speakers. The 2017 CVMA Convention will take place in Charlottetown, Prince Edward Island from July 13–16. Participants will be able to choose from 105 sessions, with over 40 speakers and 7 wet labs — an opportunity not to be missed! The CVMA Summit will take place the morning of July 13 under the title of “The Future of Veterinary Medicine: Embracing Change and Innovation,” and will be chaired by Dr. Troye McPherson. The National Issues Forum is scheduled for that afternoon as well. Participants will be invited to engage in discussions on alternative and complimentary veterinary medicine.

The 2017 CVMA Emerging Leaders Program will again be hosted by Dr. Rick DeBowes from Washington State University. He will use a variety of didactic and experimental learning approaches to help participants gain insight into how best to lead themselves as individuals, how to communicate with those around them, and ultimately how this knowledge will better prepare them to lead those around them. The CVMA appreciates the commitment of VIROX in sponsoring this important workshop for 4 years.

(by Jost am Rhyn, CEO, CVMA)

Dr./Dre Martine Dubuc, CFIA/ACIA

récemment été établie. Le congrès 2016 de l’ACMV a aussi présenté un Atelier d’une journée complète sur la médecine corps et esprit. L’ACMV envisage sa participation éventuelle à deux conférences sur le bien-être organisées par l’Association médicale canadienne.

Communications :
La campagne de sensibilisation dans les médias sociaux #VétérinairesPartenaires, qui cible des publics cibles sur Facebook et Twitter, se poursuivra en 2017. De plus, la campagne de sensibilisation sur les tiques se déroulera de nouveau en mars. En nous fondant sur les statistiques de vente, la campagne 2016 semble avoir obtenu du succès. La Semaine de vie animale 2017 portera sur un thème lié au bien-être animal.

Les rapports indiquent que la prise de rendez-vous à l’avance est moins dispendieuse que les méthodes conventionnelles de prise des rendez-vous des clients. L’ACMV a rehaussé la sensibilisation dans le cadre d’un article publié dans le numéro de Janvier 2017 de La RVC. De plus, l’ACMV planifie une campagne de six mois pour faire la promotion de la prise de rendez-vous à l’avance en 2017.

Congrès :
Environ 1000 participants ont assisté au congrès 2016 de l’ACMV qui a offert plus de 100 ateliers et un total de 37 conférenciers. Le congrès 2017 de l’ACMV se déroulera du 13 au 16 juillet à Charlottetown, à l’Île-du-Prince-Édouard. Les participants pourront choisir parmi 105 ateliers, avec plus de 40 conférenciers et 7 laboratoires de travaux pratiques, et c’est une occasion à ne pas manquer! Le Sommet de l’ACMV aura lieu le 13 juillet en avant-midi sous le thème de «L’Avenir de la médecine vétérinaire : Adopter les changements et l’innovation» et sera présidé par la Dr. Troye McPherson. Le Forum sur les enjeux nationaux est prévu aussi pour cet après-midi. On invitera les participants à se joindre à des discussions sur la médecine vétérinaire parallèle et complémentaire.

Le Programme des futurs leaders 2017 de l’ACMV sera de nouveau animé par le Dr. Rick DeBowes de l’Université de l’État de Washington. Il emploiera diverses approches d’apprentissage didactiques et expérientielles afin d’aider les participants à découvrir comment mieux se comporter en tant que personnes, comment communiquer avec autrui et comment ces connaissances les prépareront à mieux diriger les personnes qui les entourent. L’ACMV apprécie l’engagement de VIROX envers la commandite de cet important atelier pendant une période de quatre ans.

(par Jost am Rhyn, PDG, ACMV)
CVMA and Petcard® Partner to Offer Members a New CVMA Petcard Program

Petcard, Canada’s #1 veterinary financing company, and the Canadian Veterinary Medical Association (CVMA), are pleased to announce their partnership and the new CVMA Petcard Program.

The CVMA Petcard Program provides CVMA members with convenient and affordable financing options they can offer their clients to finance treatments or products their pets need. As part of our partnership agreement, CVMA members enjoy exclusive, special benefits, incentives, and rewards.

As a veterinarian, you focus on providing the best advice to clients and care to your patients; but in today’s turbulent economic landscape, pet owners are often forced into decisions based on affordability, and not necessarily the best treatments available for their pet’s health.

For over 20 years, Petcard has been the leading Canadian choice among veterinarians and their clients for a simple reason; they understand your business. Petcard understands that running a practice is complicated and your staff has its hands full with everything from emergency cases to the day-to-day business management. Petcard designs its programs with one objective in mind — simplicity.

Petcard’s award-winning staff is recognized across the industry for providing excellent customer service. Your clients will be treated with dignity, respect and the understanding that people are more than just their credit scores. Petcard is the leader in innovating methodologies to increase approval rates and are dedicated to removing treatment barriers for your patients. The focus on customer service comes from a deep understanding that your business relationship with clients is based entirely and irrevocably on trust.

Your clients can get the treatments their pets need with flexible repayment terms suiting any budget. The CVMA Petcard Program and its exclusive services and benefits are only available to Canadian veterinary practices owned in whole or in part by current CVMA members.

For more information, visit the website (www.petcard.ca) or call 1-888-689-9876.
2017 CVMA Convention
Charlottetown, July 13–16
Unleash Your Potential!

Have you started to make your travel plans for attending the 2017 Canadian Veterinary Medical Association Convention in Charlottetown, July 13–16? Think about coming early, or staying late to explore Charlottetown and the island. The CVMA’s Professional Development Committee has planned an exciting continuing education (CE) program with top-notch speakers. With the guidance of 2017 Local Chair, Dr. Kathleen MacMillan, the social evening will be a PEI kitchen party and will be held at the Lobster on the Wharf restaurant, a 5-minute walk from the Delta hotel. The evening features lobster and other delicacies with local entertainers.

The CVMA Convention offers unique and exclusive events. One of them is the CVMA Emerging Leaders Program (ELP). Going into its 9th year, this workshop offers veterinarians and registered veterinary technologists and technicians an opportunity to explore their approach to personal and professional accomplishments, and their working relationship with colleagues. This workshop is open to all CVMA and the Registered Veterinary Technologists and Technicians of Canada (RVTTC) members for a registration fee of $200. A workshop of this caliber offered elsewhere would be at least triple the cost!

The CVMA ELP shows that veterinary practice can be fun if you let it be! Facilitator Dr. Rick DeBowes is a professor of surgery and director of the Professional Life Skills Program at the Washington State University, College of Veterinary Medicine.

Dr./Dre Letitia Chow

Dr./Dre Jessica Robertson

Congrès 2017 de l’ACMV
Charlottetown, du 13 au 16 juillet
Libérez votre potentiel!

Avez-vous déjà commencé à planifier votre voyage pour assister au congrès 2017 de l’Association canadienne des médecins vétérinaires qui se déroulera du 13 au 16 juillet à Charlottetown? Prévoyez arriver tôt ou restez après le congrès pour explorer Charlottetown et l’Île.


Le congrès de l’ACMV offre des activités uniques et exclusives. L’une d’entre elles sera le Programme des futurs leaders (PFL) de l’ACMV. Cet atelier, qui en est à sa 9e édition, offre aux vétérinaires et aux technologues et aux techniciens vétérinaires agréés l’occasion d’explorer leur approche face aux réalisations personnelles et professionnelles et ainsi qu’envers leur relation de travail avec les collègues. Cet atelier est ouvert à tous les membres de l’ACMV et de Technologues et techniciens vétérinaires agréés du Canada (TTVAC) moyennant des frais d’inscription de 200 $. Un atelier de ce calibre offert ailleurs coûterait facilement trois fois le prix!

Le PFL de l’ACMV montre comment la pratique vétérinaire peut être amusante si on s’y prend de la bonne façon! L’animateur Dr. Rick DeBowes est professeur de chirurgie et directeur du Programme des compétences de vie professionnelle au Collège de médecine vétérinaire de l’Université de l’État de Washington. Il a présenté ce programme unique aux étudiants, aux professeurs, aux praticiens et aux membres d’équipes de soins de santé dans plusieurs pays sur quatre continents.

Dr./Dre Letitia Chow
Pendant la journée, les participants apprennent comment peut se dérouler une journée de travail plus fructueuse et réussie, quels sont les aspects qui sont importants pour chaque participant et comment ils peuvent atteindre ces objectifs non seulement au travail, mais aussi dans leur vie personnelle. Le Dr DeBowes enseignera aussi au groupe comment interagir plus efficacement avec les collègues en surmontant les insécurités personnelles.

La Dr Letitia Chow, participante au PFL de 2014, a dit : « Dr Rick DeBowes était un excellent conférencier. Il était interactif et engaging. J'ai aimé les histoires qu'il racontait pour communiquer ses propres expériences avec les défis quotidiens de la pratique, ses stratégies d’adaptation et ses propres philosophies sur la façon de vivre sa vie et les pratiques inspirées par les personnes autour de lui. J'ai quitté cet atelier en éprouvant un grand enthousiasme pour la participation dans ma collectivité et ma clinique. »

La Dr Jessica Robertson, une vétérinaire remplaçante qui est travailleuse autonome avec de l'expertise en pratique générale des petits animaux a assisté au PFL en 2016. Elle a dit : « Je ne savais pas à quoi m'attendre lors du PFL, mais les témoignages m'ont rendu optimiste qu'il s'agirait d'une expérience intéressante et unique. Je peux honnêtement dire que cet atelier a dépassé mes attentes. Il a éveillé ma curiosité et mon enthousiasme pour la médecine vétérinaire et l'interaction humaine plus que tout autre événement dont je puis me souvenir. J'adore être vétérinaire, mais je me perds souvent dans les menus détails de mon travail, qui sont littéralement microscopiques. Le PFL m'a encouragé à prendre du recul et à envisager la situation d'ensemble. Il m'a mis au défi d'approcher les situations d'un point de vue et il m'a donné des compétences pratiques et concrètes que je pourrais rapporter à la maison pour améliorer mon travail et ma vie à l'extérieur du travail. »


L'ACMV remercie chaleureusement Virox Animal Health de son soutien financier du PFL.

(by Ruta Klicius, CMP, Manager, CVMA Conventions)
March is National Tick Awareness Month
Help drive home the importance of early tick control

March is just around the corner; which means that, in many parts of the country, ticks are about to “wake up” hungry and looking for a host to feed on — like your clients’ pets.

It also means that it’s time to gear up for the start of the 2nd annual National Tick Awareness Month (NTAM), a client-education initiative introduced last March by the Canadian Veterinary Medical Association (CVMA) in partnership with Merck Animal Health.

Thanks to the enthusiastic response of the Canadian veterinary community to last year’s inaugural campaign, a growing number of pet owners across the country are now aware of the risk of exposure to ticks in early spring, and are taking measures to protect their pets and their families against these parasites and the diseases they can carry.

The veterinary community may not be able stop tick expansion, but there’s still a great deal we can do to help change public perceptions and behaviors when it comes to tick control. Getting on board and promoting the 2017 National Tick Awareness Month is a good place to start.

“We were greatly encouraged by the feedback we received following last year’s campaign, which received an 88% satisfaction rating,” says CVMA president, Dr. Troy Bourque. “Even more rewarding was learning that 95% of participants appreciated the communication tools provided, especially the waiting room posters and social media posts, that proved to be very popular!”

To help support the 2017 campaign, the CVMA and Merck Animal Health are once again making available to clinics the NTAM waiting room posters and ready-to-use, cut-and-paste social media posts. As suggested by veterinarians who took part in NTAM last year, a public relations campaign will be added to the mix to help spread the word and increase media awareness during the month of March.

Veterinarians and clinic team members are also invited to sign up for the National Tick Awareness Month launch webinar.

Mars est le mois national de la sensibilisation aux tiques
Soulignez l’importance d’un contrôle des tiques précoce

Le mois de mars approche à grands pas et cela signifie que, dans beaucoup de régions du pays, les tiques commencent à se réveiller et qu’elles sont « affamées » et cherchent un hôte pour se nourrir, comme les animaux de vos clients.

Cela signifie aussi qu’il est temps de se préparer au début du deuxième Mois national annuel de la sensibilisation aux tiques, une initiative d’éducation des clients introduite en mars dernier par l’Association canadienne des médecins vétérinaires (ACMV), en partenariat avec Merck Santé animale.

Grâce à la réponse enthousiaste de la collectivité vétérinaire canadienne lors de la campagne inaugurale de l’an dernier, un nombre grandissant de propriétaires d’animaux au pays sont maintenant conscients du risque d’exposition aux tiques au début du printemps et ils prennent des mesures pour protéger leurs animaux et leurs familles contre ces parasites et les maladies dont ils peuvent être porteurs.

La collectivité n’est peut-être pas en mesure de freiner l’expansion des tiques, mais il y a encore beaucoup de mesures qu’elle peut déployer afin d’aider à modifier les perceptions et les comportements du public en lien avec le contrôle des tiques. La participation au Mois national de sensibilisation aux tiques 2017 et la promotion de cette activité représentent un bon départ.

“Nous avons été fortement encouragés par la rétroaction reçue après la campagne de l’an dernier, qui a obtenu un taux de satisfaction de 88 %, a dit le président de l’ACMV, le Dr Troy Bourque. “Il était encore plus satisfaisant d’apprendre que 95% des participants avaient apprécié les outils de communication qui avaient été fournis, particulièrement les affiches pour la salle d’attente et les messages pour les médias sociaux qui se sont avérés très populaires!”

Afin d’appuyer la campagne 2017, l’ACMV et Merck Santé animale offrent de nouveau aux cliniques les affiches pour la salle d’attente et des messages pour les médias sociaux prêts à utiliser. Conformément aux suggestions des vétérinaires qui ont participé au mois de l’an dernier, une campagne de relations publiques viendra s’ajouter afin de communiquer le message et d’accroître la sensibilisation des médias durant le mois de mars.

Les vétérinaires et les membres des équipes de la clinique sont aussi invités à s’inscrire au webinaire de lancement du Mois national de la sensibilisation aux tiques qui présentera le Dr. Scott Stevenson, B.M.Sc., M.Sc., D.M.V., et la D’re Robbin Lindsay, B.Sc., M.Sc., Ph.D. Ce webinaire portera sur les stratégies de prévention des tiques et des maladies transmises par les tiques ainsi que des
CVMA Green Veterinary Practice: Evaluating Eco Responsibility of Your Suppliers

The Canadian Veterinary Medical Association’s (CVMA) Green Veterinary Practice initiative is an online collection of eco-friendly resources that offers many tips on how to make your veterinary practice more environmentally friendly.

As the owner or manager of a veterinary practice, you are the customer dealing with veterinary product suppliers. Where possible, choose businesses that share your vision for environmental stewardship. Have discussions with the sales representatives for your computer systems, pharmaceutical suppliers, medical equipment, and office supply companies. Let them know that eco-responsible business is an important component of your practice. Continued pressure from the veterinary profession demanding environmentally friendly packaging, production and delivery will eventually foster change. Don’t forget to include even simple services such as office cleaning, snow removal and laundry services when making eco-responsible choices.

Public Works and Government Services of Canada provide a Policy on Green Procurement: Tips and Tools for Suppliers that will help you pose questions to suppliers to verify that they meet your environmental stewardship criteria. Visit the Public Works and Government Services of Canada website for details (www.tpsgc-pwgsc.gc.ca/app-acq/ac-gp/pacoef-pgppts-eng.html).

Visit the “Practice & Economics” section of CVMA’s website (www.canadianveterinarians.net) to access the Green Veterinary Practice initiative.

CVMA Green Veterinary Practice:

Pratique vétérinaire écoresponsable de l’ACMV : Évaluer l’écoresponsabilité de vos fournisseurs

L’initiative d’une Pratique vétérinaire écoresponsable de l’Association canadienne des médecins vétérinaires (ACMV) est une collection en ligne de ressources écologiques qui contient une foule de conseils sur la façon d’améliorer l’empreinte écologique de votre pratique vétérinaire.

En tant que propriétaire ou gestionnaire d’une pratique vétérinaire, vous êtes le client qui traite avec vos fournisseurs de produits vétérinaires. Dans la mesure du possible, choisissez des entreprises qui partagent votre vision d’une gestion responsable de l’environnement. Tenez des discussions avec le représentant pour vos systèmes informatiques, les fournisseurs pharmaceutiques ainsi que les compagnies d’équipement médical et de fournitures de bureau. Dites-leur qu’une entreprise écoresponsable représente un élément important de votre pratique. À la longue, des pressions continues de la part de la profession vétérinaire exigeront des emballages, une production et une livraison écologiques favoriseront des changements. N’oubliez pas d’inclure de simples services comme le nettoyage du bureau, le déneigement et les services de buanderie lorsque vous faites des choix écoresponsables.

Travaux Publics et Services gouvernementaux Canada fournissent une section de Trousse d’outils sur les achats écologiques qui vous aidera à poser des questions aux fournisseurs afin de vérifier s’ils satisfont à vos critères de gestion de l’environnement. Visitez le site Web de Travaux publics et Services gouvernementaux Canada pour obtenir plus de détails (www.tpsgc-pwgsc.gc.ca/app-acq/ae-gp/pacoef-pgppts-fra.html).

Visitez la section «Pratique et finances» du site Web de l’ACMV (www.veterinairesaucanada.net) pour accéder à l’initiative d’une Pratique vétérinaire écoresponsable.
CVMA welcomes Dr. Christopher Bell to Council

The Canadian Veterinary Medical Association (CVMA) is pleased to welcome Dr. Christopher Bell who began his term as the representative of CVMA members in Manitoba on Council and as the Council Liaison to the CVMA Animal Welfare Committee on January 1, 2017.

Dr. Bell replaces Dr. Kevin Millar, as the Manitoba representative, whose term came to an end on December 31, 2016. We thank Dr. Millar for his commitment to this role, as well as his dedication as the chair of the CVMA Awards Committee.

Dr. Bell, originally from Airdrie, Alberta, grew up on a horse farm. He attended the University of Saskatchewan where he obtained a BSc with Honors in Microbiology and Immunology. Dr. Bell proceeded to attain a DVM with Distinction from the Western College of Veterinary Medicine (WCVM). He then completed a one-year clinical internship at Arizona Equine Medical and Surgical Center, followed by a 3-year surgical residency program at WCVM. Dr. Bell also completed a Master’s of Veterinary Science during his residency program. He is a board-certified Diplomate of the American College of Veterinary Surgeons and has published in the areas of immunology, navicular disease, MRI imaging, ligament reconstructions, and upper airway surgery in the horse.

He is an active member of the Manitoba Veterinary Medical Association (MVMA) and serves as the WCVM Advisory Committee Liaison and sits on the Professional Image Committee for the MVMA. Dr. Bell previously served on the Practice Inspection Committee. He is a recognized speaker and has presented at provincial, national and international levels in the areas of lameness, ethanol fusion of the hocks, MRI diagnosis and treatment of navicular disease, and development of novel sinusitis treatments in horses.

Dr. Bell also participates in the Red River College Animal Health Technology teaching curriculum as host site for the equine anesthesia laboratory. He is also a member of the Red River College curriculum advisory committee and Animal Health Technologist advisory committee for the Red River College AHT degree program.

He is an active member of the equine community, sitting on several committees and boards within Manitoba such as the Manitoba Horse Council Breeds and Industry Committee. At the national/international level, Dr. Bell currently serves as the American Association of Equine Practitioners Liaison with the MVMA.

Dr. Bell’s main areas of focus are equine surgery and sports medicine (lameness diagnosis, imaging and treatment) in addition to the routine equine health needs of his clients.

Dr. Bell has owned Elders Equine Veterinary Service since 2012. When he is not at work, he enjoys spending time with his wife, 2 daughters, and their chocolate lab.

L’ACMV accueille le Dr Christopher Bell au sein du Conseil

L’Association canadienne des médecins vétérinaires (ACMV) est heureuse d’accueillir le Dr Christopher Bell au sein du Conseil. Il a entamé son mandat le 1er janvier 2017 à titre de représentant des membres de l’ACMV au Manitoba et en tant qu’agent de liaison du Conseil auprès du Comité sur le bien-être animal de l’ACMV.

Le Dr Bell remplace le Dr Kevin Millar, dont le mandat a pris fin le 31 décembre 2016, à titre de représentant du Manitoba. Nous remercions le Dr Millar de son dévouement dans le cadre de ces fonctions ainsi qu’à titre de président du Comité des prix de l’ACMV.

Le Dr Bell, qui est originaire d’Airdrie, en Alberta, a grandi dans une ferme équestre. Il a fréquenté l’Université de la Saskatchewan où il a obtenu un BSc avec spécialisation en microbiologie et en immunologie. Le Dr Bell a ensuite obtenu un D.M.V. avec distinction du Western College of Veterinary Medicine (WCVM) et a effectué un internat clinique d’un an à l’Arizona Equine Medical and Surgical Center, suivi d’un programme de résidence chirurgicale de trois ans au WCVM. Le Dr Bell a aussi obtenu une maîtrise en sciences vétérinaires durant son programme de résidence. C’est un diplomate agréé de l’American College of Veterinary Surgeons et il a publié dans les domaines de l’immunologie, de la maladie naviculaire, de l’imagerie à résonance magnétique, des reconstructions de ligaments et de la chirurgie des voies respiratoires supérieures chez les chevaux.

C’est un membre actif de la Manitoba Veterinary Medical Association (MVMA), il siège à titre d’agent de liaison au Comité consultatif du WCVM et il est membre du Comité de l’image professionnelle de la MVMA. Le Dr Bell est aussi un ancien membre du Comité de l’inspection des pratiques. C’est un conférencier reconnu et il a donné des présentations sur la scène provinciale, nationale et internationale dans les domaines de la boiterie, de la fusion à l’éthanol des jarrets, du diagnostic à l’IRM et du traitement de la maladie naviculaire ainsi que du développement de traitements novateurs pour la sinusite chez les chevaux.

Le Dr Bell participe aussi à l’enseignement du curriculum de technologie de la santé animale à Red River College en tant que lieu d’enseignement du laboratoire de l’anesthésie équine. Il est aussi membre du comité consultatif du curriculum de Red River College et du comité consultatif des technologies en santé animale du programme de TSA de Red River College.

C’est un membre actif de la collectivité équestre et il siège à plusieurs comités et conseils au Manitoba, dont le comité des races et de l’industrie du Manitoba Horse Council. À l’échelle nationale et internationale, le Dr Bell occupe actuellement le poste d’agent de liaison de l’American Association of Equine Practitioners auprès de la MVMA.

Les principaux domaines d’intérêt du Dr Bell sont la chirurgie équine et la médecine sportive (diagnostic de la boiterie, imagerie et traitement) en plus de veiller aux besoins de routine de ses clients en matière de santé équine.

Le Dr Bell est propriétaire de l’Elders Equine Veterinary Service depuis 2012. Lorsqu’il n’est pas au travail, il aime passer du temps en compagnie de sa femme, de ses deux filles et de leur Labrador chocolat.
Case Report  Rapport de cas

Use of canine sourced platelet-rich plasma in a feline contaminated cutaneous wound

Francesco Gemignani, Anna Perazzi, Ilaria Iacopetti

Abstract — A 4-year-old neutered female domestic shorthaired cat was treated with canine sourced platelet-rich plasma at the Veterinary Hospital at University of Padua for a large skin defect on the left lateral neck region. The wound healed completely within 20 days and no adverse reaction was observed during the healing process.

Résumé — Usage du plasma riche en plaquettes de source canine pour une blessure cutanée féline contaminée. Une chatte domestique stérilisée âgée de 4 ans a été traitée à l’aide de plasma canin riche en plaquettes à l’hôpital vétérinaire de l’Université de Padoue pour un défaut cutané important dans la région latérale gauche du cou. La plaie a guéri complètement dans un délai de 20 jours et aucune réaction indésirable n’a été observée durant le processus de guérison.

Can Vet J 2017;58:141–144

In both animal and human patients, proper wound healing depends on several variables including blood supply, defect size, tension and mobility of wound margins, susceptibility to infection, and type and condition of underlying tissue (1–3). Skin healing is a dynamic event that involves different phases and cellular interactions coordinated by cytokines and growth factors (4). Several clinical studies on the restoration of tissue integrity have shown the positive role of platelets in natural wound healing (2,5). According to the “pull theory” (6), wound contraction is mediated by fibroblasts and myofibroblasts generated in response to platelet derived growth factors and macrophage derived growth factors. Platelet-rich plasma (PRP) is defined as a portion of the plasma fraction of blood having a high number of platelets and growth factors concentrated in a limited volume of plasma (1,7,8). Platelet-rich plasma is a recent therapeutic component of regenerative and human sport medicine; attractive features of PRP therapy include being minimally invasive, rapid, inexpensive, and relatively easy to prepare (9). Platelet-rich plasma is known to enhance hemostasis, wound healing, re-epithelialization, and tissue regeneration (1,3–5,10–12). To achieve these effects, the platelet concentration must be more than 4 to 5 times the baseline intravascular platelet count (9,13), which is considered the minimal concentration for accelerated epithelialization and granulation (7). Autologous PRP is increasingly used in therapeutic tissue regeneration, as evidenced by several published clinical and experimental reports in human medicine in both non-healing and healing wounds (1,5,14). The use of platelet concentrate for therapeutic purposes is a recent technology in veterinary medicine, particularly in equine and canine medicine (2,7,8,10,11,15–18). To the best of our knowledge, there are no published reports that describe the use of autologous or heterologous PRP in wound healing in cats, although canine serum has been used in feline patients for the treatment of corneal ulcers with encouraging clinical experiences, without literature support (19). This report describes the successful application of canine PRP on a large skin defect in a cat.

Case description

A 4-year-old neutered female domestic shorthaired cat weighing 3.0 kg was presented to the Veterinary Hospital at the University of Padua for a traumatic large, contaminated wound in the jugular region (Figure 1). The owner reported that the cat had been injured by a dog bite 2 d earlier. On presentation no abnormalities were found on general physical examination; body temperature, mucous membranes, and capillary refill time were all within normal limits. Routine hematology and biochemistry were unremarkable. Serological tests for feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV) were negative. The wound bed appeared to be covered by an avascular sheet of necrotic tissue without effusion. Neither foreign bodies nor bone fragments were found inside the wound. The skin surrounding the wound was warm and swollen. Based on the case history and clinical examination, the wound was classified as a full-thickness contaminated wound. Hair was clipped from the area around the wound and all debris was removed. The wound was then cleaned with a sterile saline solution administered under pressure by an 18-gauge needle attached to a 35-mL syringe.
to generate 7 to 8 psi. Following lavage the wound measured 23 mm x 46 mm (Figure 2A).

Due to the dimensions and contamination of the defect, the wound was left to heal by second intention since simple apposition of the edges of the wound created significant tension. Furthermore, it was decided to not close the wound using reconstructive plastic surgery because this would have required general anesthesia for the patient and a greater economic investment by the owner. Instead, the wound was treated with the application of PRP to stimulate the healing process. Given the need to use a large volume of whole blood for the preparation of the required PRP, with the agreement of the cat’s owner, it was decided to obtain PRP from a blood sample from a single healthy adult dog. The donor dog was kept in an individual kennel with water and food ad libitum and a complete cell count of blood from the donor was conducted (Table 1). The initial platelet count of the donor indicated that sample was satisfactory for the preparation of PRP. The PRP was prepared by the tube method described by Perazzi et al (15). A 16-mL volume of blood was collected from the donor's jugular vein with commercially designed platelet sequestration tubes containing sodium citrate (Vacutainer CPT; Becton, Dickinson and Company, Franklin Lakes, New Jersey, USA) and then centrifuged to obtain 2 mL of PRP. The final 2 mL of PRP contained a mean concentration of $1.513 \times 10^3$ platelets/µL (Table 1).

The PRP solution was gently applied directly to the surface of the lesion with a sterile syringe. After the application of PRP, the wound generally remains moist and the granulation tissue that forms does not usually dry out. For this reason, a light wet-to-dry protective bandage was applied to reduce the risk of wound contamination. To monitor for possible adverse reactions, the patient was hospitalized for 5 d. During the postoperative period, clavulanic acid-potentiated amoxicillin (Synulox; Pfizer Animal Health, Latina, Italy), 20 mg/kg body weight (BW), was administered q12h for 5 d. During the recovery, no non-steroidal anti-inflammatory drugs (NSAIDS) were given. The bandage was changed every 2 d to allow for inspection of the wound, collection of data relating to the healing process, and to avoid leaving dirty gauze on the wound. The area was cleaned using a sterile isotonic saline solution without scrubbing the lesion.

There were no signs of inflammation, necrosis, infectious complications or adverse immune reaction during the healing process. The cat had neither hyperthermia, anorexia, lethargy, nor excitement. To measure the dimensions of the wound and the progression of healing, digital pictures that included a 2-dimensional calibration scale next to the wound were obtained. Using commercial software (Autocad, 2005), the total area of the wound, the percentage of wound contraction, and the percentage of re-epithelialization were calculated as described by Bohling (20) (Figures 2B–C). Macroscopic observation of wound healing was the basis for recording the quality and color of granulation tissue. With day 0 as the day of PRP application, the wound showed significant clinical improvement beginning on day 1. On day 4, there was a reduction of 50% in the wound area. On day 10, the percentage of contraction was 90%, after which complete healing was observed in another 10 d. Following wound contraction, the percentage of re-epithelialization was calculated. On day 6, we observed more than 50% of re-epithelialization, which increased to 80% at day 10. Granulation tissue was first observed at the center of the lesion on day 2. On day 4, this had covered at least 50% of the lesion and on day 6 almost 90%. The granulation bed completely filled the lesion on day 8. On day 10, the granulation tissue appeared more pale and irregular at the center of the lesion and more abundant at the edges. Wound healing was complete 20 d after treatment, with slight scar formation (Figure 2D). There was hair re-growth 25 d after the treatment, except in the area of scar tissue. At a 3-month follow-up, the patient appeared to be in good health with an excellent cosmetic result.

**Discussion**

Despite the proven efficacy of autologous platelet rich plasma in several studies (1,2,5,7,8,10,16), heterologous PRP could be a safe alternative to autologous PRP when the condition of the...
patient prevents use of its own blood. In a recent study, Abegao et al (4) used heterologous blood for the production of PRP to treat experimentally induced dermal wounds in rabbits. The positive results of this study confirmed the data reported in a previous study that described successful use of heterologous blood for the production of PRP because of the difficulties in obtaining blood from small animals (21). Beneficial effects have been also demonstrated with heterologous PRP in joint cartilage lesions (22), and corneal ulcer healing was achieved in rabbits using a heterologous blood component associated with PRP (23). Kaffashi et al (23) reported that topical application of heterologous platelet jelly and blood serum may shorten the healing period of corneal ulcerated areas leading to a better quality of healing. In our case the patient was too small to allow a sufficient volume of blood to be taken for preparation of the required autologous PRP. A similar study was recently published by Chung et al (3) who described a large skin defect in a very small dog treated with topical homologous PRP obtained from a donor of the same species (3). In that case the patient was too small to provide sufficient blood for autologous PRP. Supported by evidence of the literature and having the owners’ consent it was decided to use heterologous instead of homologous PRP to have a donor with a higher blood volume and to reduce the risk of transmission of infectious diseases.

We noticed early granulation tissue at the center of the lesion, which could explain the rapid wound contraction. Wound contraction is more effective in areas where the skin is loosely attached to the underlying tissue, but our case progressed more rapidly than normal wound contraction during healing by second intention without treatment (20,24). Bohling et al (20) described the macroscopic features of second intention induced cutaneous wound healing in the cat: the authors

**Figure 2.** Wound healing process. The panel shows the wound healing process. A – appearance of the wound after debridement: the wound measured 23 × 46 mm and the total wound area was 743.01 mm²; B – wound 8 d after the PRP application (total wound area: 198.79 mm², percentage of wound contraction: 73%, percentage of re-epithelialization: 68%); C – wound 13 d after the PRP application (total wound area: 64.01 mm², percentage of wound contraction: 91%, percentage of re-epithelialization: 84%); D – wound 20 d after the PRP application; complete wound healing with slight scar formation in the center of the area.
reported the percentages of epithelialization (13.0% at day 14 and 34.4% at day 21), wound contraction (53.0% at day 14 and 75.8% at day 21), and total healing (59.0% at day 14 and 83.9% at day 21). With regard to the percentage of contraction in our case, after 1 wk the wound contraction was 90% and complete healing was observed 20 d after the treatment. No delayed healing or exuberant granulation tissue was noted. The use of heterologous PRP was not associated with signs suggestive of infection, similar to that reported by de Rezende et al (22) and Abegão et al (4), who used heterologous PRP sources. This absence of infection, either after the PRP application or during the healing process, may be attributed to the high concentration of leucocytes with antimicrobial activity present in PRP (4).

The present report describes the safe use of heterologous platelet-rich plasma in second intention healing in a cat. Notably, there were no local or systemic adverse effects. Our findings suggest that heterologous PRP, as a topical low cost therapy, may stimulate early and good granulation tissue formation without any adverse reaction in cats. These findings could open a new field of wound therapy, particularly in patients with a small body mass or blood volume. Further investigation of the efficacy of canine PRP in large clinical trials in cats is recommended to confirm the successful results seen in this case report and to identify possible adverse effects of using PRP for this application.

### References

Diaphragmatic hernias are an uncommon source of colic and respiratory signs in equine neonates (1–3). A recent study described 137 equine neonates < 30 d old with colic, 15 (11%) of which were managed surgically with open techniques, including 1 with diaphragmatic hernia (1). Although minimally invasive techniques have been reported (4,5), ventral open celiotomy affords good exposure for repair of ventral diaphragmatic defects in foals and facilitates reduction of herniated viscera (6). This report describes successful open reduction and surgical mesh repair in a 41-day-old foal with diaphragmatic laceration and hernia secondary to rib fracture.

Case description

A hospitalized 8-year-old, 523-kg, primiparous Appaloosa mare undergoing treatment for pneumonia, developed premature placental separation at 335 d of gestation. Assisted vaginal delivery facilitated birth of a 29.5-kg filly foal. The mare colostrum per nasogastric tube, 34 mL/kg BW split into 2 doses, amikacin (Amiglyde-V; Fort Dodge Animal Health, Lake Forest, Illinois, USA), 250 mg/kg BW, IV over 20 min, mannitol (Hospira, Lake Forest, Illinois, USA), 1.1 mg/kg BW, IV . Mineral oil and water were given via nasogastric tube. Abdominal radiographs taken day 7. Thoracic radiographs repeated on day 13 showed worsening bronchopneumonia. Fracture of ribs 5, 6, and 7 on the right side was also visible. Despite this, the foal continued to get stronger and began nursing from the mare. Nasogastric feeding and parenteral nutrition were then started on day 3. On day 4, the foal developed increased abdominal respiratory effort and crackles were heard on auscultation of the right thorax, in addition to an audible click of the right hemithorax. Subsequent thoracic radiographs revealed an alveolar pattern in the cranioventral lung lobes and bronchopneumonia. Fracture of ribs 5, 6, and 7 on the right side was also visible. Despite this, the foal continued to get stronger and began nursing from the mare. Nasogastric feeding and parenteral nutrition were then discontinued on day 7. Thoracic radiographs repeated on day 13 showed worsening bronchopneumonia. In addition, the ventral aspect of the diaphragm could not be visualized, and pleural effusion was suspected, which was confirmed with thoracic ultrasound.

On day 22, the foal became lethargic and febrile. A trans-tracheal wash was performed, revealing a mixed growth of Escherichia coli and Staphylococcus spp. The antibiotic regimen was then changed to chloramphenicol (Vicent; Bimeda, Le Sueur, Minnesota, USA), 50 mg/kg BW, PO, q6h, and nebulization with amikacin, q24h for 8 d. Radiographs on day 25 showed mild improvement in the pneumonia but evidence of bronchitis in the caudal lungs. On day 35, the foal developed signs of colic. Colic signs resolved with administration of flunixin meglumine (Prevail; Bimeda-MTC Animal Health, Cambridge, Ontario), 1.1 mg/kg BW, IV, Mineral oil and water were given via nasogastric tube. Abdominal radiographs taken on day 36 revealed gas-filled loops of intestine, as well as a cavitated soft tissue opacity in the caudal ventral thorax. Differential diagnoses included diaphragmatic hernia and a caudal ventral
lung abscess, in addition to colonic impaction. At this time, the foal had not defecated for 24 h. A muzzle was placed to prevent ingestion of hay or straw, but the filly was allowed to nurse hourly. Crystalloid IV fluids (Veterinary Plasma-lyte A; Abbott, North Chicago, Illinois, USA) were administered as boluses at 10 mL/kg BW, q4h, and another dose of mineral oil was administered via nasogastric tube. On day 39, crystalloid IV fluids were discontinued and the foal was nursing well and produced normal feces. On day 41, signs of colic returned. Radiographic and ultrasonographic examination confirmed diaphragmatic hernia based on presence of intestinal loops within the thoracic cavity (Figure 1). Surgery was recommended to repair the hernia.

Following pre-oxygenation, the foal was induced with ketamine (VetaKet; Akron, Lake Forest, Illinois, USA), 3 mg/kg BW, IV and diazepam (Hospira), 0.1 mg/kg BW, IV and maintained on isoflurane (Piramal Health Care, Bethlehem, Pennsylvania, USA) in 100% oxygen with positive pressure ventilation. Lidocaine (Hospira), 10 mg/kg BW per minute, IV and lactated ringer’s solution (Hospira), 2 mL/kg BW per hour, IV, were administered during surgery.

A routine ventral midline celiotomy incision was created following aseptic preparation. A 10-cm diameter circular defect was found in the ventral right diaphragm, through which the large colon and a small amount of jejunum were incarcerated in the right thorax. Using gentle traction, the entrapped bowel was removed from the thorax. Removal was facilitated by digital separation of several fibrinous adhesions between the bowel and thoracic body wall adjacent to the site of rib fracture. An omentectomy was performed to remove a segment of omentum adhered to the edge of the diaphragmatic defect. The size of the diaphragmatic defect prevented primary closure. A double layer of woven plastic surgical mesh (Proxplast; Goshen Laboratories, Goshen, New York, USA) was positioned over the defect and secured in place with #2 interrupted horizontal mattress polyglactin 910 sutures (Vicryl; Ethicon, San Angelo, Texas, USA). Balfour retractors facilitated surgical exposure. The incarcerated intestines appeared healthy except for a 1-cm diameter abraded area of the large colon, which was oversewn with 2-0 carbonate-dioxanone copolymer (Biosyn; US Surgical, Norwalk, Connecticut, USA) in a cushing pattern. Sterile 1% carboxymethylcellulose solution (Aqualon; Ashland, Russell, Kentucky, USA) was instilled before closure. A tube (Argyle trochar catheter, sharp tip, 5.3 mm × 25 cm; Covidien, Mansfield, Massachusetts, USA) was placed transcutaneously in the right thoracic cavity to allow evacuation of air and fluid, and was maintained for 24 h after surgery. The foal recovered well from anesthesia.

Chloramphenicol, 50 mg/kg BW, PO, q6h, and crystalloid IV fluids (Veterinary Plasma-lyte A), 10 mL/kg BW, q4h, were continued for 7 d. Eight days after surgery, thoracic radiographs revealed resolving bronchopneumonia. The foal was discharged 19 days after surgery. The abdominal incision was healing well upon recheck 5 wk after hospital discharge. Radiographs confirmed resolution of pneumonia. A follow-up phone call to the owner 42 mo later revealed that the horse had no further illnesses or injuries and was doing well in training.

**Discussion**

An acquired diaphragmatic hernia was identified in the foal in this report. The diaphragmatic hernia was assumed to be due to traumatic laceration secondary to displaced rib fractures. The diaphragmatic defect was located adjacent to the fracture location near the costochondral junction of the right 5th, 6th, and 7th ribs and surrounding ossification, similar to previous reports (7). Also supportive of traumatic diaphragmatic laceration was the omental adhesion present on the edge of the defect (8). Birth trauma is a common source of neonatal rib fractures, especially in filly foals born to primiparous dams and with dystocia (9–11). Ultrasonographic imaging has been recommended to assess foals with suspected rib fracture because of...
improved sensitivity in detection and characterization of thoracic abnormalities in these cases (9,10). Foals with fractures of the 4th, 5th, and 6th ribs are most likely to develop serious trauma of the surrounding soft tissues, including diaphragmatic laceration, resulting in life-threatening injury (9,12,13). Displaced rib fractures are often accompanied by an audible clicking sound during respiration, as in the present case. Early surgical repair of the rib fracture before fracture displacement might have avoided further injury, although repair at the time of diaphragmatic herniorrhaphy was not deemed necessary due to stable healing ossification, which is known to occur approximately 4 to 6 wk after injury in foals sustaining rib fracture in the neonatal period (12). The chronicity of cases in many horses with diaphragmatic hernia suggests a variable duration between traumatic diaphragmatic injury and herniation of alimentary contents, resulting in acute clinical signs of colic and/or respiratory distress (14). While it is likely that the foal herein developed the diaphragmatic laceration in the first week of life, acute incarceration of the viscera in the thoracic cavity precipitated further workup and eventual surgical correction of the defect at 41 d of age.

Diagnosis of diaphragmatic hernia can be challenging, with inconsistent history and physical examination findings (14). Diaphragmatic hernias often result in primarily colic signs, and less commonly with respiratory distress alone (14). The severity of clinical signs and prognosis are related to type, amount, and viability of the herniated abdominal contents (3). In most reported cases of diaphragmatic defects in horses, herniated contents are composed of small intestine or multiple alimentary organs, such as liver, stomach, and small intestines (2). Herniation of the large intestines into the thoracic cavity, with colonic haustra visible on thoracic radiographic examination, has been mentioned in previous reports (14), although the herniated colon is often non-viable contributing to poor prognosis (15). In addition to herniated viscera, hemoabdomen, hemothorax, and subsequent death have been described in 2 neonatal foals with acute rib fracture and diaphragmatic laceration in one report (9) and these conditions have been associated with acute neonatal rib fracture in other reports (13). The prognosis of the foal in the present report was good because of the minimal intestinal vascular compromise, although careful manipulation was still necessary to prevent intestinal perforation during reduction of the herniated contents, which has been reported during attempted removal of the large colon from the thorax of a horse (2). Large colon herniation is more commonly associated with right-sided diaphragmatic defects (6,7,14–16), as in the present report. Congenital and acquired hernias can occur on the left and right portions of the diaphragm, although left-sided defects are more common (2,3) which might, in part, account for the less common occurrence of large colon herniation.

Repair of diaphragmatic hernias in horses can be challenging, often due to the size and location of the tear. Correction of herniated alimentary organs alone, without direct repair, has not been successful due to the rapid recurrence of the entrapment (17). Furthermore, failure rates of diaphragmatic defect repairs are high, most occurring during anesthetic recovery (2,4,7) or within 30 d after surgery (2,3). Mesh repair has been reserved for large defects (7,16), defects in dorsal locations precluding direct suturing from a ventral celiotomy (17), and to complement and strengthen traditional suturing techniques (8). Despite perceived improvement in the strength of the diaphragmatic defects repaired with mesh, early failures still occur (2,4), perhaps due to weakness in the repaired tissues or high strain on the repaired defects during anesthetic recovery. Surgical mesh was used in the foal in the present report because of the size of the diaphragmatic defect and concerns regarding undue tension on the repair if direct suturing alone was utilized. The location of the implanted surgical mesh was, in part, covered by the liver, which limited contact with gastrointestinal organs and potentially minimized serosal abrasion and adhesion formation. Eschewing mesh (18) or complete separation of implanted mesh from viscera might result in the lowest risk (8), although as post-operative adhesions have been detected at celiotomy following traditional direct suturing techniques of diaphragmatic defects in horses (2), the surgeon should focus on repair integrity as a primary goal of the procedure.

In the present case, a chest tube was used to evacuate air from the right hemi-thorax at the end of the surgical procedure and was maintained through anesthetic recovery and for 24 h after surgery before removal. Maintenance of a chest tube during anesthetic recovery is critical to allow rapid intervention in foals that re-establish pneumothorax, which is a known source of co-morbidity and death following diaphragmatic herniorrhaphy (1,2). Radiographic or other imaging modalities could be used to confirm lung inflation prior to removal (4), though cessation of gas and fluid removal are also used to confirm appropriate timing of chest tube removal. Although poor ventilation, hypoxemia, and atelectasis commonly accompany herniation of alimentary organs into the thorax and re-expansion injury is a concern, removal of displaced organs from the thorax has been identified as the single most helpful factor in improving ventilation and gas exchange (19).

Survival rates of horses with diaphragmatic hernia are estimated to be between 11% and 25% (2–4). For horses undergoing surgical correction of diaphragmatic hernia, survival percentages are increased to between approximately 46% and 67% (2–4). In one report, 3 of 6 foals undergoing surgery for diaphragmatic hernia were euthanized during surgery due to presence and amount of compromised herniated intestine and of the 3 undergoing surgical repair, only 1 survived to hospital discharge (2). Although prognosis for surgical correction of diaphragmatic hernia in horses is fair, and even poorer in foals, if the initial repair is successful and does not fail in the immediate post-operative period, prognosis for return to athletic function can be good (2,4,17,20), as in the present case.

References
Article

Perioperative analgesic use by Ontario veterinarians, 2012
Jessica Reimann, Cate Dewey, Shane W. Bateman, Carolyn Kerr, Ron Johnson

Abstract — The objectives of this study were to describe the routine use of analgesics by Ontario veterinarians for common surgeries in dogs and cats, and to compare routine use of analgesics between species and surgeries, using Chi-square analyses. In total, 239 veterinarians responded to the questionnaires; a response rate of 13.1%. Fifty-two percent to 79% of veterinarians used meloxicam for both species and all surgeries. Approximately 9% of veterinarians did not use analgesics for dog ovariohysterectomy and castration, while 16% to 22% did not use analgesics for these surgeries in cats. Veterinarians used and dispensed analgesics to dogs more often than to cats ($P < 0.05$). Many (60% or more) veterinarians administered analgesics pre-emptively to both dogs and cats for all surgeries. Continuing education for veterinarians needs to focus on understanding of pre-emptive analgesia, preventive analgesia, and the importance of dispensing analgesic drugs after surgery for all surgeries.

Résumé — Utilisation de l’analgésie péri-opératoire par les vétérinaires de l’Ontario, 2012. Les objectifs de cette étude consistaient à décrire l’utilisation routinière de l’analgésie par les vétérinaires de l’Ontario pour les chirurgies courantes chez les chiens et les chats et à comparer l’utilisation routinière de l’analgésie entre les espèces et les chirurgies en utilisant des analyses du chi-carré. Au total, 239 vétérinaires ont répondu aux questionnaires, pour un taux de réponse de 13,1 %. De cinquante-deux à 79 % des vétérinaires avaient recours au méloxicam pour les deux espèces et toutes les chirurgies. Environ 9 % des vétérinaires n’ont pas utilisé d’analgésie pour l’ovario-hystérectomie et la castration canines, tandis que de 16 % à 22 % n’ont pas eu recours à l’analgésie pour ces chirurgies chez les chats. Les vétérinaires utilisaient et distribuaient des analgésiques aux chiens plus souvent qu’aux chats ($P < 0.05$). Plusieurs vétérinaires (60 % ou plus) ont administré des analgésiques de manière préventive aux chiens et aux chats pour toutes les chirurgies. La formation continue des vétérinaires doit continuer de se concentrer sur la compréhension de l’analgésie préventive et sur l’importance d’administrer des analgésiques après la chirurgie pour toutes les chirurgies.

Can Vet J 2017;58:149–156

Introduction

Analgesic medications to reduce surgical pain are crucial for the wellbeing and overall health of an animal (1). The College of Veterinarians of Ontario (CVO) states that it is the ethical obligation of veterinary professionals to prevent and relieve pain in animals (2). Veterinary professionals’ interest in and knowledge of evaluating and treating pain in animals has increased (3). A greater understanding of the pathophysiologic process of pain transmission has led to more comprehensive guidelines for perioperative pain management (3).

All animals undergoing surgical procedures should receive analgesia (2). Hansen and Hardie in 1993 (4) were the first to question the adequacy of post-surgical analgesia. Their study, conducted in a United States veterinary teaching hospital, characterized the frequency and determinants of post-surgical analgesic intervention in companion animals. In that study, 7% of cats received analgesia after surgery, while 28% of dogs received analgesia after extubation (4). In a subsequent Canadian study (5), veterinarians surveyed about post-operative pain management were classified as analgesic users or non-users. Animals undergoing orthopedic surgery received the highest rates of analgesic medication at 84% and 70% of dogs and cats, respectively (5). Animals undergoing castration received the lowest rate of post-operative analgesics, with only 11% of dogs and 9% of cats receiving analgesics. Similar studies in other countries also investigated analgesic use by veterinarians (6–9). All reported inadequate analgesic use, especially for the most common surgeries, ovariohysterectomy and castration. Another Canadian study in 2001 asked veterinarians about
pre- and post-incisional analgesic use (10). These authors reported that the frequency of post-operative analgesic use had increased in Canada compared with a 1996 study (10). In 2002, studies in Finland and New Zealand reported disparities in analgesic use between dogs and cats (11,12). Although both species had similar pain scores, dogs received analgesia more frequently than did cats. Similarly, a study of veterinarians in Britain concluded that the veterinary profession is increasing analgesic use over time (13). Although use in dogs was comparatively high, use in cats required improvement. More recently, studies in Brazil and Switzerland evaluated the use of multimodal and pre-emptive analgesic techniques, with the latter used by more than 70% of veterinarians (14,15).

Despite the improvements noted, there remains an important gap in knowledge about provision of ideal patient care. The objectives of the current study were to describe the use of analgesics by Ontario veterinarians for routine elective surgeries in dogs and cats, and to compare routine use of analgesics between dogs and cats, and among types of surgery.

Materials and methods

A questionnaire, developed in an iterative manner by the senior authors (CD, CK, RJ), was based on the overall objectives of the study and the expectations of participants completing the study online. Portions of the questionnaire were modeled after surveys by Williams et al (12) and Hewson et al (10). Veterinary graduate students at the Ontario Veterinary College (OVC) and 12 veterinarians in private practice pre-tested the initial draft. The pre-test veterinarians were chosen by geographic location, year of graduation, and type of practice. The questionnaire was reduced in size and complexity, and was limited to require either dog or cat responses per participant based on feedback from the pre-test.

On approval of the project by the University of Guelph Research Ethics Board, participants were recruited through both the Ontario Veterinary Medical Association (OVMA) magazine and the OVMA online newsletter. Study participants were licensed Ontario veterinarians who had an e-mail address, were members of the OVMA, and reported that they regularly treated dogs and/or cats in their practices. Responses to the questionnaire were collected through LimeSurvey (LimeSurvey Project Team 2015, LimeSurvey Project, Hamburg, Germany), a self-administered online survey tool. The questionnaire was available to participants from September 13, 2012 to January 6, 2013.

Participants who graduated in odd years were asked to complete the questionnaire focused on dog surgery, while even-year graduates were asked to complete the cat questionnaire. Participants had the option of completing the second questionnaire. The questions on the species-based questionnaire were the same, except that respondents were asked about analgesic use for cruciate surgery in dogs and onychectomy in cats. For each completed questionnaire, participants were offered an entry in a draw for free registration to the 2014 OVMA conference.

The questionnaires included demographic questions, and 6 additional sections addressing multiple aspects of veterinarians’ attitudes and practices regarding pain management and analgesic use. Questions pertaining to demographics included gender, year of graduation, and school of graduation. This manuscript reports on the section of the questionnaire pertaining to the routine use of analgesics, specifically, timing and route of administration, and choice of analgesics for each of several routine elective surgeries.

Participants were asked if they routinely or never gave analgesic drugs to dogs or cats for 5 common surgical procedures. The specified surgeries were ovariohysterectomy, castration, dental procedures with major extractions, laparotomy, cruciate repair (dog only), and onychectomy (cat only). The data presented are from a survey of practicing veterinarians who perform these surgeries routinely. From a list of 9 analgesic drugs, consisting of non-steroidal anti-inflammatory drugs (NSAIDs) approved for use in animals, and some opioids, participants were asked to select the analgesic used and its common route of administration, for each surgery. Participants were also asked about timing of analgesic administration, where they could choose from 4 options: before or during surgery, pre-extubation, or post-extubation. Pre-emptive analgesia referred to administration of an analgesic before surgery. Additionally, participating veterinarians were asked which analgesics were routinely dispensed after surgery. For each question, there was an option for the participant to include up to 3 analgesics that were not listed, in a section called “other.”

Statistical analyses

All statistical analyses were performed using STATA version 13.1 (StataCorp LP, College Station, Texas, USA). Descriptive statistics were generated to describe perioperative analgesic use and analgesics dispensed by surgery type in dogs and in cats. Pearson’s Chi-squared tests were used to identify differences in the proportions of veterinarians using specific analgesics for i) specific surgeries between species, and ii) within species and among surgeries, iii) drugs dispensed by surgery between species, and iv) drugs dispensed within species among surgeries. The strengths of the significant associations were described by an odds ratio. Fisher’s exact tests were used when the expected value of any 1 cell represented fewer than 5 veterinarians.

Frequency counts of the number of veterinarians using any analgesic drug during each of the time points were tabulated. The 3 most commonly used analgesics by timing within species and surgery were reported, provided that at least 4% of the respondents used the analgesic. Logistic regression was used to determine the association between gender and year of graduation on the analgesic use within surgery between species and among surgeries within species before, during, and after surgery. Year of graduation by gender was determined for 5-year intervals by graduation year. This distribution of participants was compared to that of OVMA membership using Pearson’s Chi-squared tests. Statistical analysis outcomes were considered significant at a $P < 0.05$ level.

Results

One hundred participants completed the dog questionnaire and were included in the analysis. Of these participants, 66.0% were female, 30.0% were male, and 4.0% did not disclose their gender. The cat questionnaire was completed by 139 participants.
Of these participants 69.1% were female, 30.2% were male, and 0.7% did not disclose their gender. The majority of respondents to either the dog or cat questionnaire had graduated from the OVC (84.0% and 83.5%, respectively). Neither gender nor year of graduation was associated with analgesic use. For most graduation years, respondents were reflective of the demographic distribution of the OVMA. Women who graduated between 2010 and 2012 were more likely to participate (OR = 1.7; 1.07 to 2.63; \( P = 0.02 \)), however, women who graduated between 1990 and 1994 were less likely to participate (OR = 0.4; 0.23 to 0.83; \( P = 0.009 \)). Overall, women were more likely to participate than men (OR = 1.8; 1.3 to 2.4; \( P = 0.0001 \)) and in particular, men who graduated between 1995 and 1999 were less likely to participate (OR = 0.16; 0.06 to 0.38; \( P < 0.0001 \)). Most respondents to both the dog and cat questionnaires worked in small animal practice (87.0% and 83.4%, respectively), including 1% from feline-only practices. Nine percent of those who completed the dog questionnaire and 11.0% of those who completed the cat questionnaire were in mixed-animal practices, with the remainder being in referral practices or other categories. Of the 1691 OVMA members 15.3% of those working in small animal practice and 5.0% working in mixed-animal practice responded. The overall response rate for the questionnaires was 13.1%.

Analgesics used by veterinarians, in dogs and cats, according to surgery type, are presented in Table 1. Meloxicam was the most commonly used analgesic across the 2 species and all surgeries, followed by hydromorphone. Between 8% and 10% of veterinarians did not report using analgesics for dogs during ovariohysterectomy and castration surgeries. Similarly, 16% and 22% of veterinarians did not report using analgesics for cats for ovariohysterectomy and castration surgeries, respectively. Carprofen was administered to cats (off-label) for ovariohysterectomy and castration surgeries by 1% to 2% of veterinarians. Fentanyl was used in 19% of dogs undergoing cruciate repairs and 14% of cats undergoing onychectomy; significantly greater than fentanyl use for other surgeries (\( P < 0.05 \)). Local anesthetics were administered to both dogs and cats for all surgery types, and were given by more than half of the veterinarians surveyed to animals undergoing dental procedures with major extractions. Tramadol and ketamine were the most common drugs listed as “other.”

Reports of timing of analgesic administration are provided in Table 2. Greater than 61% of veterinarians reported administering analgesic drugs pre-emptively to both dogs and cats for all surgeries. The percentage of veterinarians dispensing analgesics after surgery varied both by surgery type and between the 2 species (Table 3).

Deracoxib, meloxicam, and tramadol were more likely to be dispensed for dogs than for cats after ovariohysterectomy and castration. However, buprenorphine was more often dispensed for cats than dogs after ovariohysterectomy, dental procedures, and exploratory laparotomy. Analgesic drugs were more often dispensed for dogs than for cats. For ovariohysterectomy and castration, 17% and 26% of veterinarians, respectively, did not dispense analgesics for dogs. For ovariohysterectomy and castration, 34% and 62% of veterinarians, respectively, did not dispense analgesics for cats.

Table 4 illustrates the timing of treatment for the 3 most commonly used analgesics within species and by surgery type. In both dogs and cats, hydromorphone and butorphanol were most commonly administered before surgery. Meloxicam was administered most frequently during and after surgery.

**Discussion**

Meloxicam was the most commonly used analgesic for both dogs and cats and among surgeries (Table 1). This finding differs from earlier studies conducted in New Zealand (12), and in Canada (10), in which carprofen and butorphanol were the 2 most commonly used perioperative analgesics. Meloxicam, an NSAID, was approved for use in veterinary medicine in Canada in 2003 (16). The use of meloxicam has increased since the previous Canadian study (10). When the last survey was conducted in Canada (in 2001), meloxicam was not licensed for use in cats (10). In dogs, Mathews et al (17) reported that meloxicam has a longer and more efficacious analgesic effect than butorphanol.

Carprofen was the second most common NSAID reported in dogs in this study (Table 1). Carprofen was used by 83% of veterinarians in New Zealand for dogs and cats (12). In New Zealand, carprofen is approved for use in both cats and dogs. Carprofen has a shorter duration of action (12 to 18 h) (18) than meloxicam (24 h) (17), but is an acceptable analgesic in veterinary practice (19). Authors have suggested that a single dose of carprofen in the perioperative period is an effective and safe analgesic. However, when repeated doses are required other NSAIDs have safer feline profiles than carprofen, which can cause renal toxicity (20). In Canada, use of carprofen in cats constitutes extra-label drug usage.

Butorphanol was used as a perioperative analgesic by 22% to 45% of veterinarians in this study, depending on species and surgery. Butorphanol has a short duration of action (1 to 2 h) (21,22) and is suggested only when surgery is anticipated to produce mild to moderate pain, such as ovariohysterectomy and castration (1). Although it is an opioid, butorphanol is not licensed in Canada as an analgesic for dogs and cats, but rather as an antitussive for dogs (22). In the current study, butorphanol was most often administered before surgery and appeared among the top 3 drugs administered before surgery across all surgeries and both species (Table 4). This differs from the previous Canadian study, in which butorphanol was the most commonly used drug both before and after incision (10). Previous to that, butorphanol was the opioid most commonly used by Canadian veterinarians for post-operative pain control (5). Ontario veterinarians are now more commonly using NSAIDs during and after surgery, rather than using opioids for post-operative analgesia (Table 4). Butorphanol, a kappa agonist/mu antagonist, can reverse the effects of pure mu agonists such as hydromorphone and fentanyl if they are administered together (23), leaving the animal with only mild analgesic effects. Both hydromorphone and fentanyl are more potent full opioid analgesics, and therefore more effective than butorphanol (22). Hydromorphone has a longer duration of action (2 to 4 h) than that of butorphanol (22), and was the opioid administered most often in the current
Veterinarians indicated that they routinely administered butorphanol, hydromorphone, and fentanyl for various surgeries. Our survey questions did not allow us to distinguish whether it is not expected to have substantial opioid effects in dogs (24). Although tramadol appears to be effective in cats (24), this is not always the case in animals. Although tramadol was administered in the perioperative period to 3% to 8% of dogs and up to 3% of cats, and dispersed to 8% to 40% of dogs and up to 7% of cats. Local anesthetics were administered perioperatively to both dogs and cats for all surgeries in this study. The highest percentage of veterinarians administered local anesthetics perioperatively for dental surgeries with major extractions in both dogs and cats, and to cats during onychectomy. In comparison, most participants in a recent British study did not commonly use local anesthetic techniques perioperatively (13). The previous Canadian study also reported low usage of local anesthetics (10), with the highest use of local anesthetic blocks for tail docking in puppies (11%) and onychectomy. In comparison, most participants in a recent study indicated extra-label drug use. Although dogs and cats react differently to analgesic drugs, there is no evidence to suggest that they might feel pain differently or have different veterinary concerns about the side effects of analgesic drugs in another area of focus for continuing education. Although dogs and cats react differently to analgesic drugs, there is no evidence to suggest that they might feel pain differently or have different veterinary concerns about the side effects of analgesic drugs in another area of focus for continuing education.

Veterinary approved analgesics:

- **Non steroidal anti-inflammatory drugs**
  - Carprofen
  - Deracoxib
  - Ketoprofen
  - Meloxicam
  - Robenacoxib
  - Tolmetin

- **Opioids**
  - Buprenorphine
  - Butorphanol
  - Fentanyl
  - Hydromorphone
  - Meperidine
  - Morphine

- **Other**
  - Acepromazine
  - Alpha-2 agonists
  - Ketamine
  - Tramadol
  - Local anesthetic

- **No drug used**

For personal use only.

### Table 1. Percent of participating Ontario veterinarians routinely using specific analgesics perioperatively in dogs (n = 100) and cats (n = 139), 2012

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>Ovariohysterectomy</th>
<th>Castration</th>
<th>Dental with major extractions</th>
<th>Cruciate repair</th>
<th>Onychectomy</th>
<th>Exploratory laparotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dog (%)</td>
<td>Cat (%)</td>
<td>Dog (%)</td>
<td>Cat (%)</td>
<td>Dog (%)</td>
<td>Cat (%)</td>
</tr>
<tr>
<td>Non steroidal anti-inflammatory drugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carprofen*</td>
<td>17 ± 1</td>
<td>16 ± 2</td>
<td>0 ± 2</td>
<td>14 ± 0</td>
<td>0 ± 0</td>
<td>16 ± 0</td>
</tr>
<tr>
<td>Deracoxib*</td>
<td>7 ± 1</td>
<td>7 ± 1</td>
<td>1 ± 1</td>
<td>7 ± 0</td>
<td>0 ± 6</td>
<td>1 ± 0</td>
</tr>
<tr>
<td>Ketoprofen*</td>
<td>1 ± 3</td>
<td>1 ± 4</td>
<td>0 ± 3</td>
<td>1 ± 0</td>
<td>0 ± 3</td>
<td>3 ± 0</td>
</tr>
<tr>
<td>Meloxicam*</td>
<td>79 ± 4</td>
<td>77 ± 5</td>
<td>65 ± 1</td>
<td>68 ± 1</td>
<td>69 ± 3</td>
<td>61 ± 4</td>
</tr>
<tr>
<td>Robenacoxib*</td>
<td>0 ± 1</td>
<td>0 ± 1</td>
<td>0 ± 3</td>
<td>0 ± 3</td>
<td>3 ± 0</td>
<td>1 ± 0</td>
</tr>
<tr>
<td>Tolmetin</td>
<td>0 ± 3</td>
<td>0 ± 3</td>
<td>0 ± 3</td>
<td>0 ± 3</td>
<td>3 ± 0</td>
<td>1 ± 0</td>
</tr>
<tr>
<td>Opioids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buprenorphine*</td>
<td>22 ± 0</td>
<td>19 ± 2</td>
<td>28 ± 0</td>
<td>20 ± 0</td>
<td>45 ± 0</td>
<td>20 ± 2</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>42 ± 6</td>
<td>45 ± 4</td>
<td>40 ± 6</td>
<td>36 ± 3</td>
<td>33 ± 15</td>
<td>33 ± 15</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>6 ± 0</td>
<td>1 ± 1</td>
<td>4 ± 0</td>
<td>4 ± 0</td>
<td>19 ± 4</td>
<td>14 ± 4</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>66 ± 3</td>
<td>65 ± 5</td>
<td>30 ± 6</td>
<td>47 ± 4</td>
<td>49 ± 3</td>
<td>69 ± 5</td>
</tr>
<tr>
<td>Meperidine</td>
<td>2 ± 1</td>
<td>2 ± 2</td>
<td>2 ± 2</td>
<td>2 ± 2</td>
<td>3 ± 2</td>
<td>2 ± 2</td>
</tr>
<tr>
<td>Morphine</td>
<td>4 ± 0</td>
<td>1 ± 0</td>
<td>2 ± 1</td>
<td>5 ± 0</td>
<td>1 ± 0</td>
<td>1 ± 0</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acepromazine†</td>
<td>2 ± 1</td>
<td>1 ± 1</td>
<td>2 ± 1</td>
<td>2 ± 1</td>
<td>1 ± 1</td>
<td>1 ± 1</td>
</tr>
<tr>
<td>Alpha-2 agonists†</td>
<td>15 ± 0</td>
<td>12 ± 0</td>
<td>16 ± 0</td>
<td>13 ± 0</td>
<td>12 ± 0</td>
<td>12 ± 0</td>
</tr>
<tr>
<td>Ketamine†</td>
<td>4 ± 6</td>
<td>4 ± 4</td>
<td>4 ± 6</td>
<td>4 ± 6</td>
<td>5 ± 6</td>
<td>6 ± 6</td>
</tr>
<tr>
<td>Tramadol</td>
<td>4 ± 0</td>
<td>3 ± 0</td>
<td>7 ± 3</td>
<td>8 ± 2</td>
<td>2 ± 6</td>
<td>6 ± 0</td>
</tr>
<tr>
<td>Local anesthetic</td>
<td>25 ± 4</td>
<td>33 ± 5</td>
<td>25 ± 4</td>
<td>54 ± 1</td>
<td>50 ± 1</td>
<td>29 ± 1</td>
</tr>
<tr>
<td>No drug used</td>
<td>8 ± 0</td>
<td>10 ± 1</td>
<td>22 ± 1</td>
<td>13 ± 0</td>
<td>14 ± 0</td>
<td>23 ± 1</td>
</tr>
</tbody>
</table>

*Within surgery, drug use differs between species (P < 0.05).
†Within species, within drug, use of specific drug differs between surgeries (P < 0.05).
AP = Approved for use as an analgesic in dogs in Canada.
BP = Approved for use as an analgesic in cats in Canada.
CP = Approved for use as an analgesic in dogs and cats in Canada.
DP = Approved for use as an analgesic in cats in Canada.
EP = Approved for use in dogs, not as an analgesic.
FP = Approved for use in cats, not as an analgesic.
NR = Not reported. Some veterinarians may not perform these surgeries.
pain management (3). Analgesic drugs inhibit sensitization of nerves to pain at the peripheral and central nervous system levels. Initiating treatment before noxious input into the nervous system can help prevent the peripheral and central sensitization process (25). This is known as pre-emptive analgesia, in which peripheral and central sensitization are controlled by administering analgesic drugs before surgery (3).

The 1996 survey in Canada asked veterinarians about their use of analgesics after surgery (5). The 2006 Canadian study reported 87% to 97% of dogs received pre-incisional analgesics for the surgeries the survey asked about (10). There was no question on pre-emptive analgesia. Cats received pre-incisional analgesics 87% to 92% of the time (10). Pascoe (26) suggests that it is far better to prevent pain than to treat it, and this should be accomplished through pre-medication. He states that pre-medication should be used to decrease anxiety, as well as providing analgesia before the painful procedure. At least 61% and 71% of veterinarians reported administering analgesics to dogs and cats, respectively, before surgery. Pre-emptive pain relief is especially important for shorter surgeries in which an analgesic may have to be administered early to reach therapeutic effect in order to control post-operative pain (17). While pre-emptive analgesia is an important concept, it is also imperative that we consider an approach that minimizes the long-term negative complications associated with poor management techniques. Preventive analgesia is a broader approach to pain management, focused on the importance of good analgesia practices throughout the perioperative period (27). This pain management practice decreases postoperative pain and lowers analgesic requirements.

Multi-modal analgesia, which promotes the use of 2 or more classes of analgesic drugs as safer and more effective than a single class of drugs alone (3), is recommended as an important tool.

### Table 2. Percent of participating Ontario veterinarians routinely administering analgesics perioperatively at a specific time during surgery in dogs and cats, 2012

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>Ovario-hysterectomy</th>
<th>Castration</th>
<th>Dental with major extractions</th>
<th>Cruciate repair</th>
<th>Onychectomy</th>
<th>Exploratory laparotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timing</strong></td>
<td><strong>Dog</strong></td>
<td><strong>Cat</strong></td>
<td><strong>Dog</strong></td>
<td><strong>Cat</strong></td>
<td><strong>Dog</strong></td>
<td><strong>Cat</strong></td>
</tr>
<tr>
<td>Before</td>
<td>89</td>
<td>79</td>
<td>87</td>
<td>71</td>
<td>85</td>
<td>74</td>
</tr>
<tr>
<td>During</td>
<td>86</td>
<td>79</td>
<td>85</td>
<td>74</td>
<td>85</td>
<td>74</td>
</tr>
<tr>
<td>Pre-extubation</td>
<td>45</td>
<td>40</td>
<td>40</td>
<td>29</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>Post-extubation</td>
<td>20</td>
<td>23</td>
<td>20</td>
<td>16</td>
<td>23</td>
<td>26</td>
</tr>
<tr>
<td>Dispensed</td>
<td>85</td>
<td>66</td>
<td>74</td>
<td>38</td>
<td>86</td>
<td>76</td>
</tr>
</tbody>
</table>

NR — Not reported, assumed some veterinarians may not perform these surgeries.

### Table 3. Analgesics dispensed by Ontario veterinarians (%) to dogs (n = 100) and cats (n = 139) following specific surgical procedures

<table>
<thead>
<tr>
<th>Surgical procedure</th>
<th>Ovario-hysterectomy</th>
<th>Castration</th>
<th>Dental with major extractions</th>
<th>Cruciate repair</th>
<th>Onychectomy</th>
<th>Exploratory laparotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of analgesic</td>
<td>Drug</td>
<td><strong>Dog</strong></td>
<td><strong>Cat</strong></td>
<td><strong>Dog</strong></td>
<td><strong>Cat</strong></td>
<td><strong>Dog</strong></td>
</tr>
<tr>
<td>Non steroidal anti-inflammatory</td>
<td>Carprofen</td>
<td>17a</td>
<td>0b</td>
<td>16a</td>
<td>0b</td>
<td>12a</td>
</tr>
<tr>
<td></td>
<td>Deracoxib</td>
<td>9a</td>
<td>1b</td>
<td>8a</td>
<td>0b</td>
<td>8a</td>
</tr>
<tr>
<td></td>
<td>Ketoprofen</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Meloxicam</td>
<td>68a</td>
<td>52b,c</td>
<td>60a</td>
<td>31b,d</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Robenacoxib</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Tolfenamic acid</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Opioids</td>
<td>Buprenorphine</td>
<td>3a</td>
<td>20b,c</td>
<td>3</td>
<td>7d</td>
<td>8a</td>
</tr>
<tr>
<td></td>
<td>Butorphanol</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Codeine</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Fentanyl</td>
<td>1c</td>
<td>1c</td>
<td>0e</td>
<td>0e</td>
<td>2c</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>Alpha-2 agonists</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Gabapentin</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Tramadol</td>
<td>16ace</td>
<td>1b</td>
<td>8ace</td>
<td>1b</td>
<td>37ace</td>
</tr>
<tr>
<td></td>
<td>No drug dispensed</td>
<td>17ace</td>
<td>34ace</td>
<td>26ace,d</td>
<td>62ace,d</td>
<td>14ace</td>
</tr>
</tbody>
</table>

* Within surgery, drug dispensing differs between species (P < 0.05).
* Within species, within drug, dispensing of specific drug differs between surgeries (P < 0.05).
* Approved for use as an analgesic in dogs in Canada.
* Approved for use as an analgesic in dogs and cats in Canada.
* Approved for use as an analgesic in cats in Canada.
* Approved for use in dogs, not as an analgesic.
* NR — not reported, assume some veterinarians may not perform these surgeries.
in pain management (28). However, the current study did not determine how many veterinarians are using multimodal analgesia. Earlier studies rarely reported use of multimodal analgesia (5,8,9,11). A British study suggested that the importance of using multiple classes of drugs had been recognized, yet this approach was not widely used (7). Similarly, in South Africa, multimodal drug use was recommended but not investigated (8). Since then, many recommendations to use both an NSAID and an opioid have surfaced (1,3,15,28). The combination of these 2 classes of drugs generally confers better analgesia for moderate to severe pain through a synergistic effect (1). The use of local anesthetics by veterinarians in the current study speaks to potential multimodal analgesic use in this population. The rationale is that local anesthetics are rarely administered to provide multimodal analgesia. Earlier studies rarely reported use of multimodal analgesia (5,8,9,11). A British study suggested that the importance of using multiple classes of drugs had been recognized, yet this approach was not widely used (7). Similarly, in South Africa, multimodal drug use was recommended but not investigated (8). Since then, many recommendations to use both an NSAID and an opioid have surfaced (1,3,15,28). The combination of these 2 classes of drugs generally confers better analgesia for moderate to severe pain through a synergistic effect (1). The use of local anesthetics by veterinarians in the current study speaks to potential multimodal analgesic use in this population. The rationale is that local anesthetics are rarely administered as

Table 4. The 3 most frequently used drugs by species, surgery, and time of administration as described by Ontario veterinarians, 2012

<table>
<thead>
<tr>
<th>Timing</th>
<th>Dog</th>
<th>Cat</th>
<th>Timing</th>
<th>Dog</th>
<th>Cat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A — Ovariohysterectomy</strong></td>
<td></td>
<td></td>
<td><strong>B — Castration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>Hydromorphone (48%)</td>
<td>Butorphanol (40%)</td>
<td>Before</td>
<td>Hydromorphone (41%)</td>
<td>Butorphanol (33%)</td>
</tr>
<tr>
<td></td>
<td>Butorphanol (39%)</td>
<td>Hydromorphone (32%)</td>
<td>Local (15%)</td>
<td>Butorphanol (33%)</td>
<td>Hydromorphone (34%)</td>
</tr>
<tr>
<td></td>
<td>Local (15%)</td>
<td>Buprenorphine (14%)</td>
<td>Local (25%)</td>
<td>Butorphanol (30%)</td>
<td>Local (26%)</td>
</tr>
<tr>
<td>During</td>
<td>Meloxicam (26%)</td>
<td>Meloxicam (20%)</td>
<td>During</td>
<td>Local (31%)</td>
<td>Meloxicam (23%)</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone (11%)</td>
<td>Butorphanol (10%)</td>
<td>Meloxicam (31%)</td>
<td>Hydromorphone (11%)</td>
<td>Meloxicam (20%)</td>
</tr>
<tr>
<td></td>
<td>Local (8%)</td>
<td>Hydromorphone (9%)</td>
<td>Hydromorphone (7%)</td>
<td>Meloxicam (7%)</td>
<td>Meloxicam (7%)</td>
</tr>
<tr>
<td>Pre-extubation</td>
<td>Meloxicam (33%)</td>
<td>Meloxicam (33%)</td>
<td>Pre-extubation</td>
<td>Meloxicam (30%)</td>
<td>Meloxicam (29%)</td>
</tr>
<tr>
<td></td>
<td>Carprofen (6%)</td>
<td>Buprenorphine (6%)</td>
<td>Carprofen (6%)</td>
<td>Carprofen (6%)</td>
<td>Buprenorphine (7%)</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone (5%)</td>
<td>Hydromorphone (5%)</td>
<td>Hydromorphone (5%)</td>
<td>Hydromorphone (5%)</td>
<td>Hydromorphone (5%)</td>
</tr>
<tr>
<td>Post-extubation</td>
<td>Meloxicam (7%)</td>
<td>Buprenorphine (11%)</td>
<td>Post-extubation</td>
<td>Meloxicam (8%)</td>
<td>Buprenorphine (16%)</td>
</tr>
<tr>
<td></td>
<td>Meloxicam (8%)</td>
<td>Buprenorphine (8%)</td>
<td>Meloxicam (5%)</td>
<td>Meloxicam (8%)</td>
<td>Meloxicam (8%)</td>
</tr>
<tr>
<td>Dispensed</td>
<td>Meloxicam (68%)</td>
<td>Meloxicam (52%)</td>
<td>Dispensed</td>
<td>Meloxicam (68%)</td>
<td>Meloxicam (60%)</td>
</tr>
<tr>
<td></td>
<td>Carprofen (17%)</td>
<td>Butorphanine (20%)</td>
<td>Carprofen (12%)</td>
<td>Carprofen (12%)</td>
<td>Buprenorphine (8%)</td>
</tr>
<tr>
<td></td>
<td>Tramadol (16%)</td>
<td></td>
<td></td>
<td></td>
<td>Codeine (7%)</td>
</tr>
<tr>
<td><strong>C — Dental with major extractions</strong></td>
<td></td>
<td></td>
<td><strong>D — Exploratory laparotomy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>Butorphanol (43%)</td>
<td>Butorphanol (37%)</td>
<td>Before</td>
<td>Hydromorphone (50%)</td>
<td>Butorphanol (28%)</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone (40%)</td>
<td>Hydromorphone (25%)</td>
<td>Local (23%)</td>
<td>Hydromorphone (28%)</td>
<td>Hydromorphone (35%)</td>
</tr>
<tr>
<td></td>
<td>Local (23%)</td>
<td>Hydromorphone (19%)</td>
<td>Local (12%)</td>
<td>Butorphanol (30%)</td>
<td>Buprenorphine (15%)</td>
</tr>
<tr>
<td>During</td>
<td>Meloxicam (23%)</td>
<td>Meloxicam (19%)</td>
<td>During</td>
<td>Meloxicam (19%)</td>
<td>Buprenorphine (5%)</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone (10%)</td>
<td>Hydromorphone (13%)</td>
<td>Hydromorphone (10%)</td>
<td>Hydromorphone (10%)</td>
<td>Buprenorphine (5%)</td>
</tr>
<tr>
<td></td>
<td>Local (9%)</td>
<td></td>
<td>Local (9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-extubation</td>
<td>Meloxicam (31%)</td>
<td>Meloxicam (24%)</td>
<td>Pre-extubation</td>
<td>Meloxicam (27%)</td>
<td>Buprenorphine (9%)</td>
</tr>
<tr>
<td></td>
<td>Hydromorphone (5%)</td>
<td>Buprenorphine (6%)</td>
<td>Meloxicam (7%)</td>
<td>Carprofen (6%)</td>
<td>Buprenorphine (4%)</td>
</tr>
<tr>
<td></td>
<td>Carprofen (5%)</td>
<td></td>
<td>Meloxicam (7%)</td>
<td>Carprofen (6%)</td>
<td>Buprenorphine (9%)</td>
</tr>
<tr>
<td>Post-extubation</td>
<td>Meloxicam (10%)</td>
<td>Meloxicam (9%)</td>
<td>Post-extubation</td>
<td>Meloxicam (7%)</td>
<td>Buprenorphine (14%)</td>
</tr>
<tr>
<td></td>
<td>Deracoxib (4%)</td>
<td>Buprenorphine (6%)</td>
<td>Meloxicam (7%)</td>
<td>Buprenorphine (6%)</td>
<td>Buprenorphine (14%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Meloxicam (7%)</td>
<td>Buprenorphine (6%)</td>
<td>Buprenorphine (14%)</td>
</tr>
<tr>
<td>Dispensed</td>
<td>Meloxicam (60%)</td>
<td>Meloxicam (31%)</td>
<td>Dispensed</td>
<td>Meloxicam (60%)</td>
<td>Meloxicam (54%)</td>
</tr>
<tr>
<td></td>
<td>Carprofen (16%)</td>
<td>Buprenorphine (7%)</td>
<td>Carprofen (39%)</td>
<td>Carprofen (15%)</td>
<td>Meloxicam (54%)</td>
</tr>
<tr>
<td></td>
<td>Deracoxib (8%)</td>
<td></td>
<td>Tramadol (39%)</td>
<td></td>
<td>Buprenorphine (37%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Carprofen (15%)</td>
<td></td>
<td>Tramadol (7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>E — Cruciate repair (dog) and onychectomy (cat)</strong></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydromorphone (36%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butorphanol (17%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>During</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meloxicam (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carprofen (6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local (14%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydromorphone (8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pre-extubation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meloxicam (20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carprofen (6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Post-extubation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meloxicam (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deracoxib (4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dispensed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meloxicam (52%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tramadol (40%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carprofen (13%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butorphanol (35%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl (7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the sole analgesic, and would, therefore, likely be given with another analgesic drug, as was described in a recent study by Hunt et al (13,29).

Overall, 8% to 14% of veterinarians did not report using analgesics in dogs for the surgeries included in the study, while 16% to 23% of veterinarians did not report using analgesics for surgeries for cats. This finding is concerning, given that the licensing body governing quality practice and standards in Ontario issued a position statement in October 2013, while this study was being conducted, directing that veterinarians were obligated to provide analgesia to all patients where the potential for pain exists (2). Clearly, a greater focus on continuing education is needed to meet the professional ethical standard in Ontario. A recent study in Switzerland showed more Swiss veterinarians (92% to 98%) than Ontario veterinarians reporting using analgesia during surgery (15). However, in Brazil, fewer veterinarians (78%), than those in the current study, reported giving analgesic drugs to cats during ovariohysterectomy (14).

Our questionnaire specifically asked about analgesic use for specific surgeries. However, one of the important limitations of our work is that participants were unable to indicate that they did not perform any of the given surgeries. This is likely most significant for cruciate surgery in dogs and onychectomy in cats, as well as exploratory laparotomy in both species. It is possible that individuals who did not report using analgesics in fact did not perform the surgery in question. They would then have been misclassified as analgesic non-users. We assume that most veterinarians who elected to complete the survey are involved in elective sterilization procedures. The potential lack of use of analgesia in these surgical procedures thus remains an important focus for education and priority for future studies.

In contrast to the previous Canadian study, our questionnaire asked about dispensing analgesic medication after common surgeries (10). For most surgeries, veterinarians reported dispensing analgesics for both dogs and cats, although veterinarians treating dogs (74% to 86%) consistently dispensed analgesics more often than when treating cats (38% to 76%). Meloxicam was most often dispensed across both species and all surgeries. Dispensing an NSAID has many positive implications, as NSAIDs have been proven to be effective for pain control and are available in once per-day oral formulations (30).

Buprenorphine was the opioid most commonly dispensed for cats in this study and was occasionally dispensed for dogs. Buprenorphine has a bioavailability of only 3% to 6% when administered orally to dogs (31). Between 3% and 8% of veterinarians dispensed buprenorphine to dogs for various routine surgeries. The route of administration for buprenorphine when dispensed was not included in this study.

This study summarizes the use of analgesics by 239 veterinarians in Ontario. This is similar to the number of veterinarians surveyed in previous studies across Canada (5,10). However, the previous studies sent questionnaires to a random sample of veterinarians. The current study was available to all veterinarians who were members of the OVMA. In total, 15.3% of OVMA members in small animal practice participated in this study, but only 5.0% of those in mixed animal practice participated. On the basis of demographics, the participants were mostly representative of OVMA members by gender and year of graduation. The low response rate is likely due to the length of the questionnaire, individuals being unaware of the survey, and/or the limitation of using an online format only.

Bias may have been introduced in several ways because of the voluntary nature of the questionnaire. This effect may have also been driven by the incentive provided. Also the demographics of OVMA members may bias the demographics of those who participated in the survey. Since the questionnaire specifically asked about analgesic use, it is also possible that non-responders did not wish to discuss their analgesic use, in contrast to responders. The characteristics of the non-responders are unknown.

This study has identified many positive perioperative analgesic practices. This is the first study in Canada to collect information on analgesics dispensed and their use before, during, and after surgery. The common practice of analgesic use (60% to 92% in dogs and 77% to 84% in cats), and the number of veterinarians reporting use of pre-emptive analgesia (for example, 89% for ovariohysterectomy in dogs) are encouraging. Continuing education for veterinarians needs to focus on routine use of analgesics for all dogs and cats undergoing routine surgery, and the importance of pre-emptive analgesia, and of dispensing analgesic drugs after surgery. Future research is needed to establish whether veterinarians are employing a multimodal approach effectively, if they use a preventive analgesia plan, and also the reasons for not using analgesics for routine surgeries.

Acknowledgments
We are grateful to the OVMA for advertising the survey to their members and for providing demographics of the members. We also thank all participating veterinarians and we acknowledge funding from Pet Trust.

References


Comparative efficacy of oral meloxicam and phenylbutazone in 2 experimental pain models in the horse

UCVM Class of 2016,* Heidi Banse, Alastair E. Cribb

Abstract — The efficacy of oral phenylbutazone [PBZ; 4.4 mg/kg body weight (BW), q12h], a non-selective non-steroidal anti-inflammatory drug (NSAID), and oral meloxicam (MXM; 0.6 mg/kg BW, q24h), a COX-2 selective NSAID, were evaluated in 2 experimental pain models in horses: the adjustable heart bar shoe (HBS) model, primarily representative of mechanical pain, and the lipopolysaccharide-induced synovitis (SYN) model, primarily representative of inflammatory pain. In the HBS model, PBZ reduced multiple indicators of pain compared with the placebo and MXM. Meloxicam did not reduce indicators of pain relative to the placebo. In the SYN model, MXM and PBZ reduced increases in carpal skin temperature compared to the placebo. Meloxicam reduced lameness scores and lameness-induced changes in head movement compared to the placebo and PBZ. Phenylbutazone reduced lameness-induced change in head movement compared to the placebo. Overall, PBZ was more effective than MXM at reducing pain in the HBS model, while MXM was more effective at reducing pain in the SYN model at the oral doses used.

Résumé — Efficacité comparative du méloxicam oral et de la phénylbutazone dans deux modèles de douleur expérimentaux chez le cheval. L'efficacité de la phénylbutazone orale [PBZ; 4,4 mg/kg poids corporel (PC), q12h], d'un anti-inflammatoire non stéroïdien (AINS) non sélectif, et du méloxicam oral (MXM; 0,6 mg/kg PC, q24h), d'un AINS COX-2 sélectif, ont été évalués dans deux modèles de douleur expérimentaux chez des chevaux : le modèle du fer en cœur ajustable (HBS), qui représente surtout la douleur mécanique, et le modèle de la synovite induite par le lipopolysaccharide (SYN), qui représente principalement la douleur inflammatoire. Dans le modèle HBS, PBZ a réduit plusieurs indicateurs de douleur comparativement au placebo et au MXM. Le méloxicam n'a pas réduit les indicateurs de douleur par rapport au placebo. Dans le modèle SYN, MXM et PBZ ont réduit les hausses de la température de la peau carpienne comparativement au placebo. Le méloxicam a réduit les scores de boiterie et les changements induits par la boiterie dans le mouvement de la tête comparativement au placebo et à PBZ. La phénylbutazone a réduit le changement du mouvement de la tête induit par la boiterie comparativement au placebo. Dans l'ensemble, PBZ était plus efficace que MXM pour réduire la douleur dans le modèle HBS, tandis que MXM était plus efficace pour réduire la douleur dans le modèle SYN aux doses orales utilisées.

* The UCVM Class of 2016 includes Bronwyn Atkinson, Jessica Barker, Becky Bohlender, Lee Anne Bruce, Crystal Clark, Alyssa Coulombe, Christine Czapski, Justin Duval, Sarah Engbers, Jennifer Enzie, Laura Fick, Carrie Fischer, Jami Frederick, Heather Friedt, Elizabeth Hodges, Peter Jakobsen, Amy Larkin, Kristy Oatway, Susanna Ogle, Tessa Phillips, Katrina Ponich, Jennifer Roycroft, Joanna Rybicka, Jase Skelton, Bailey Smith, Tereza Stastny, Randale Stead, Evan Vandervalk, Jennifer Wheeler, Rebecca Wink, Marie Worobets. All are considered equal first authors.


Introduction

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used to treat pain and inflammation in horses. Despite a large number of studies on individual NSAIDs, there are only a few studies directly comparing the efficacy and safety of two or more NSAIDs in horses (1–5). Choice of treatment is typically based on personal clinical experience or preference (6). In Canada, there are currently 2 oral NSAIDs approved for use...
in horses: phenylbutazone and aspirin. Phenylbutazone (PBZ) is more commonly used. However, oral NSAIDs approved for use in horses in other countries, such as meloxicam and firocoxib, are used extra-label in Canada.

Pain associated with musculoskeletal (MSK) injury can be either mechanical or inflammatory in origin. However, in clinical situations the 2 types of pain frequently occur together. Inflammatory pain often follows mechanical injuries and mechanical pain can occur when inflammatory processes lead to structural changes. Muscle strain is a mechanical injury which can lead to inflammation (7) and inflammatory synovitis can lead to joint distension, which can be associated with mechanical pain (8,9). Regardless of etiology, NSAIDs are often used for treatment of pain and resolution of lameness.

The primary mechanism of action of NSAIDs is inhibition of cyclooxygenase (COX) enzymes that produce prostaglandins. There are 2 forms of COX: constitutively expressed COX-1 and inducible COX-2 enzymes. Inhibition of the COX enzymes results in a reduction in the production of prostaglandins (PG) from their arachidonic acid precursor (10) and clinically results in a reduction of pain and inflammation. These NSAIDs may be classified as non-selective if they inhibit both forms of therapeutic concentrations or COX-2 selective if they primarily inhibit COX-2 forms at therapeutic concentrations. In the horse, PBZ is considered non-selective, while MXM is considered COX-2 selective (or preferential) (11).

Nociceptive pathways and responses to mechanical and inflammatory pain are different, although prostaglandins are believed to play a role in both forms of pain (12,13). The efficacy of NSAIDs in mechanical and inflammatory pain may differ for a variety of pharmacodynamic and pharmacokinetic reasons. Secondary pharmacologic targets, COX selectivity, and concentrations in serum or target tissues (inflamed tissue or the central nervous system) all influence NSAID efficacy. Comparison of clinical efficacy, therefore, requires consideration of both inflammatory and mechanical pain.

This study assessed the efficacy of oral MXM (0.6 mg/kg BW, q24h) and oral PBZ (4.4 mg/kg BW, q12h) in 2 short-term, reversible pain models in the horse: the heart bar shoe (HBS) model (14) that induces primarily mechanical pain and the LPS-induced synovitis (SYN) model that induces primarily inflammatory pain (15). It was hypothesized that MXM and PBZ would be effective in reducing pain and/or inflammation compared with the placebo and that MXM efficacy would not be significantly different from PBZ.

### Materials and methods

#### Subjects

The study was approved by the University of Calgary’s Animal Care Committee and was conducted in accordance with the guidelines of the Canadian Council on Animal Care. Sixteen healthy horses (13.9 ± 8.2 y; 512 ± 42 kg; 8 Thoroughbreds, 3 Warmbloods, 3 Quarter Horses, and 1 Standardbred; 10 mares and 6 geldings) were included, with 8 horses assigned to each experimental model. Horses were deemed to be systemically healthy prior to study initiation on the basis of physical examination, a complete blood (cell) count (CBC), and serum biochemical analysis. Radiographs of the front feet (HBS-group) or carpi (SYN-group) were taken to rule out significant abnormalities. Horses did not show any evidence of foot pain when hoof testers were applied. Horses in the SYN-group were evaluated for front limb lameness at a trot in a straight line before enrolment in the study and were excluded if there was detectable front limb lameness.

All horses were housed in paddocks or pastures between experimental periods. On experimental days, horses were housed inside in individual stalls. Horses were fed grass hay ad libitum and had access to water at all times. Hay for the night was provided at the time of last assessment, which was at approximately 11 pm. Horses were treated in the morning at approximately 7:30 am and the new hay for the day was provided approximately 1 h later and throughout the day.

#### Overall experimental design

A randomized, blinded, 3-period, 3-way cross-over design was used. The evaluators were blinded to the treatment and the persons administering the drugs did not evaluate the horses. Horses were assigned to 1 experimental pain model and received all 3 treatments (placebo, MXM, PBZ). Lameness was induced (starting leg was randomized and alternated at each period) and treatments (order randomized) were administered at 2-week intervals. All horses had lameness induced and treatments administered on the same days. Horses were assessed (physical examination and complete assessment) the day before each experimental period to ensure no abnormalities had developed in the 2-week rest interval.

Pain was induced at \( t = -1 \) h in the HBS group and \( t = -2 \) h in the SYN group. Treatment was initiated at \( t = 0 \) h with 1 of the 3 treatments, in random order: placebo (molasses; 0.04 mL/kg BW at \( t = 0 \) and \( t = 12 \) h), meloxicam (Metacam 15 mg/mL oral suspension for horses; Boehringer Ingelheim Vetmedica, Ingelheim, Germany; 0.6 mg/kg BW at \( t = 0 \) h and placebo at \( t = 12 \) h); and phenylbutazone (Butequine oral paste; Bioniche Animal Health Canada, Belleville, Ontario; 4.4 mg/kg BW at \( t = 0 \) and \( t = 12 \) h). All treatment doses were calculated to the nearest 25 kg BW.

### Table 1. Foreman lameness scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>Sound; no detectable lameness</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Barely detectable; no head bob and only intermittently looks lame in stall (especially when turning) and/or rare and intermittent toe pointing (e.g., 1 to 2 events/min)</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Mild lameness at a walk in the stall; mild head bob when walking or turning in stall; points toe more consistently (3 to 4 events/min)</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Moderate lameness, but not non-weight bearing; more obvious head bob at walk; toe pointing frequently (5 to 6 events/min)</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Severe lameness — non-weight bearing 50% of the time; severe head bob; toe pointing whenever not walking (e.g., almost continuous), but not always 3-legged lame at a walk</td>
</tr>
<tr>
<td>Grade 5</td>
<td>Non-weight bearing 100% of the time</td>
</tr>
</tbody>
</table>
Horses were monitored for 24 h after treatment. The assessment methods and time points varied for each group. Evaluators were blinded to treatments but were aware of the leg treated and the method used to induce lameness. A team of 4 evaluators was assigned to 2 horses — 1 in the HBS and 1 in the SYN group. A minimum of 2 evaluators from the team of 4 assessed each horse at each time point throughout the study. Any horses showing significant pain [obvious discomfort or lameness at a walk (HBS) or trot (SYN)] following the 24 h experimental period received further treatment with phenylbutazone at 4.4 mg/kg BW, PO, q12 to 24 h until lameness resolved.

Heart bar shoe. As previously described (14,16,17), an adjustable heart bar shoe was placed on both front feet 1 wk before the first trial. This allowed acclimation to the new set of shoes to ensure there was no lameness associated with the shoes themselves. Pressure was placed on the frog and sole by tightening the set screw against the hinged plate. In 3 horses, the set screw stripped and the same foot was used for the 2nd and 3rd trials.

Pressure was applied at \( t = -1 \) h to produce a lameness score of 4 on the Foreman Lameness Scale (FLS) (Table 1) and an elevation in heart rate, as previously described (16). Horses were assessed immediately after pressure application and then at \( t = -40 \) min, \( -20 \) min, and 0 h to ensure that the pain score was stable prior to treatment. Pressure was adjusted as required until \( t = 0 \) h. Following a pre-treatment assessment at \( t = 0 \) h, treatment and assessments were completed at \( t = 1, 2, 3, 4, 6, 8, 12, 15, \) and 24 h post-treatment. After the \( t = 24 \) h assessment, pressure was immediately relieved from the heart bar.

Lameness was evaluated and scored in accordance with the FLS, as previously reported (Table 1) (16). To reduce subjectivity, individual components of the FLS were also evaluated separately and assigned a value (Table 2) to generate a Total Lameness Score (TLS) on a continuous scale. To validate the TLS, it was compared to the FLS in non-treated horses and a strong correlation was observed (Spearman’s rank correlation coefficient \( r = 0.96; P < 0.0001 \)). A Global Pain Score (GPS) that incorporated additional behavioral scores (Table 3) adapted from previously published scoring systems (18,19), using only components that were demonstrated to be reproducible and were relevant to MSK pain, was determined at each time point.

At each assessment, behavior was first evaluated from outside the stall and the horse was video-recorded for 5 min. Heart rate and respiratory rate were evaluated in the stall with the horse at rest. The additional components of the assessment that required movement of the horse were then completed. On completion of the study, the recorded video was reviewed to ensure consistency in behavior evaluation throughout the study and a final score was assigned.

LPS-induced synovitis. Synovitis (SYN) was induced by aseptic injection of 50 ng LPS (LPS from E. coli O55:B5, Sigma Aldrich, St. Louis, Missouri, USA) in 0.5 mL lactated ringer’s solution into the intercarpal joint, as previously described (15). In a pilot study (\( n = 5 \)), 50 ng LPS was found to be the lowest dose that induced a consistent, reproducible lameness at a trot in a straight line (unpublished data). A higher dose did not increase lameness and a dose of 0.5 ng per joint did not consistently induce clinical lameness.

Three horses during the last 2 experimental periods were sedated with detomidine (Dormosedan; Zoetis, New York, New York, USA), 3 mg, IV, (\( \sim 6 \mu g/kg \) BW) to facilitate

---

**Table 2. Total lameness score**

<table>
<thead>
<tr>
<th>Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>General lameness</td>
<td>None observed</td>
<td>Barely detectable</td>
<td>Mild lameness</td>
<td>Moderate lameness</td>
<td>Severe lameness</td>
<td>100% non-weight-bearing</td>
</tr>
<tr>
<td>Head bob</td>
<td>None</td>
<td>Occasional</td>
<td>Mild</td>
<td>Moderate</td>
<td>Marked</td>
<td>100% non-weight-bearing</td>
</tr>
<tr>
<td>Toe pointing</td>
<td>None</td>
<td>Rare</td>
<td>1 to 2 times/min</td>
<td>3 to 4 times/min</td>
<td>5 to 6 times/min continuous</td>
<td>100% non-weight-bearing</td>
</tr>
<tr>
<td>Non-weight-bearing</td>
<td>0%</td>
<td>Occasional</td>
<td>Up to 25%</td>
<td>50%</td>
<td>75%</td>
<td>100%</td>
</tr>
</tbody>
</table>

---

**Table 3. Global pain score**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pawing the floor or pointing a foot</td>
<td>Quietly standing, no pawing or pointing</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Occasionally pawing/pointing (1 to 2 times/min)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Frequent pawing/pointing (3 to 4 times/min)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Excessive pawing/pointing (&gt; 5 times/min)</td>
<td>3</td>
</tr>
<tr>
<td>Movement</td>
<td>Stands relaxed or quiet movement</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Reduced movement or mild agitation</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reluctance to move (e.g., pressing rump against stall wall) or moderate agitation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Refusal of movement or uncontrollable forward movement</td>
<td>3</td>
</tr>
<tr>
<td>Position in stall</td>
<td>At stall door, looking out</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>In middle of stall, looking out</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Looking at side wall of stall</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Back to door, looking at back wall</td>
<td>3</td>
</tr>
<tr>
<td>Ear position</td>
<td>To the front, listening (ear movement)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>To the front, but little or no movement</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ears slightly back (vertical), little movement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ears pulled back</td>
<td>3</td>
</tr>
<tr>
<td>Orbital tightening</td>
<td>Eyes open, looking around</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Eyes open or occasional partially closed, limited movement</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Eyes consistently closed up to half</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Eyes closed half or more, consistently</td>
<td>3</td>
</tr>
</tbody>
</table>
injection (including 3 placebo, 2 MXM, and 1 PBZ treatment period).

Baseline assessments were completed before joint injection at \( t = -2 \) h. Following a pre-treatment assessment at \( t = 0 \) h, the first treatment was administered and horses were then assessed at \( t = 2, 4, 6, 8, 12, 15, \) and \( 24 \) h. Horses were assessed for lameness and the need for rescue analgesia at \( t = 24 \) h.

Heart rate, respiratory rate, and carpal skin temperature were assessed with the horse at rest in the stall. Carpal skin temperature was assessed by infrared sensor thermometers (ThermoCheck; STEINEL Vertrieb GmbH, Herzebrock-Clarholz, Germany), with the same thermometer used for individual horses throughout the study. To ensure consistency, temperature was assessed within a 1.5 cm circle marked on the surface of the intercarpal joint, 2 cm lateral to the injection site and the extensor carpi radialis tendon. Carpal skin temperatures are expressed as change from baseline to account for any minor differences in baseline temperatures caused by changes in ambient temperatures between experimental periods.

A lameness score was assigned using the scoring system in Table 4. The difference in maximum and minimum head height (measured in mm) between the affected and non-affected leg strides was obtained using the Lameness Locator in accordance with the manufacturer’s instructions (Equinosis; Columbia, Missouri, USA), as previously described (20). Briefly, accelerometers were placed on the head and pelvis, and a gyroscope was placed on the right forelimb, allowing the proprietary computer program to calculate the differences in maximum and minimum head height between the left and right strides. Each horse was trotted in a straight line for a minimum of 25 strides to collect sufficient data points for analysis. Only front limb data were analyzed and the data are expressed as difference in maximum and minimum head height during the stride on the affected leg compared to the non-affected leg. In some horses, at the point of maximum lameness, the head height difference was not quantified by the Lameness Locator program algorithms because the minimum of 6 consistent strides in a row was not achieved. For these individual time points, following a manual inspection of the obtained data, a standard 10 mm was added to the difference in head movement observed at the flanking time points to create an imputed value that allowed analysis by 2-way repeated measures analysis of variance (ANOVA). A consistent value was added in all cases to minimize statistical bias in the results (21). This approach was validated by determining that adding 0, 10, or 20 mm to the flanking time point or deleting the affected time points did not change the interpretation of the data. All

### Table 4. Synovitis lameness score

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No lameness at a walk or trot</td>
</tr>
<tr>
<td>1</td>
<td>Intermittent lameness at a trot in a straight line</td>
</tr>
<tr>
<td>2</td>
<td>Consistent lameness, mild head bob at a trot in a straight line</td>
</tr>
<tr>
<td>3</td>
<td>Consistent obvious lameness, with moderate to severe head bob at a trot in a straight line</td>
</tr>
<tr>
<td>4</td>
<td>Lame with head bob at a walk</td>
</tr>
<tr>
<td>5</td>
<td>Non-weight-bearing lame</td>
</tr>
</tbody>
</table>

![Figure 1. Foreman (A) and total (B) lameness scores in horses (n = 8) with heart bar shoes following treatment with a placebo (black square), meloxicam (MXM; open circle), or phenylbutazone (PBZ; black circle). Pressure was applied at \( t = -1 \) h and treatments were administered at \( t = 0 \) h (vertical dashed line) and \( t = 12 \) h (placebo or PBZ; second vertical dashed line). Significant differences at each time point were determined by a post-hoc Tukey’s analysis following a 2-way repeated measures ANOVA. Each point represents the mean ± standard error and significant differences are shown as follows: a = \( P < 0.05 \) placebo versus MXM; b = \( P < 0.05 \) placebo versus PBZ; c = \( P < 0.05 \) MXM versus PBZ.](image-url)
statistical analyses for head movement are reported based on a complete data set using the imputed numbers.

Statistical analysis
All data are reported as mean ± standard error (SE), unless indicated otherwise. Statistical comparisons were achieved by using a 2-way repeated measures ANOVA to determine residual error and then carrying out a post-hoc analysis using Tukey’s multiple comparison method to identify significant differences at each time point between placebo, MXM, and PBZ, using commercially available software (Graph Pad Software, La Jolla, California, USA). Differences were considered significant when \( P < 0.05 \). For ease of presentation, only significant differences at individual time points are reported. In addition, \( t \)-tests were used to determine if there was any effect of the use of detomidine on the pre-treatment lameness scores in the synovitis group.

Group size was determined by comparison to previously published studies and using a simplified power analysis. Power analysis of 2-way repeated measure ANOVAs is complex and is based on a large number of assumptions. Therefore, predicted sample size was estimated based on comparisons with multiple paired \( t \)-tests. A power calculation using \( \beta = 0.8 \) and \( \alpha = 0.05 \) indicated a sample size of 8 horses per group would be sufficient to detect a 25% difference.

Results

Heart bar shoe model
Application of pressure with the HBS increased the score on the FLS from a baseline of 0 to an average of 4.5 (Figure 1). With placebo treatment, the FLS stabilized by \( t = 1 \) h and remained between 3.5 and 3.8 for the duration of the experimental period, similar to previous reports (14,16,17). Phenylbutazone significantly reduced the FLS and TLS scores compared to the placebo and MXM at multiple time points (Figure 1), with the greatest effect at \( t = 15 \) to 24 h. Meloxicam did not significantly change the FLS or the TLS compared to the placebo at any time point. The Global Pain Score (GPS; Figure 2) followed a similar pattern, with PBZ resulting in a significant reduction compared to the placebo at \( t = 4, 15, \) and 24 h and to MXM at \( t = 15 \) and 24 h. Meloxicam did not significantly change the GPS compared to the placebo at any time point.

Heart rate increased from approximately 35 at baseline to 55 beats/min (bpm) at \( t = 0 \) h and then stabilized at approximately 45 bpm by \( t = 1 \) h in placebo-treated horses (Figure 3A). Meloxicam did not significantly change heart rate compared to the placebo at any time point. Heart rate in PBZ-treated horses was significantly lower than that of the placebo at \( t = 2, 3, 15, \) and 24 h and significantly lower than that in horses treated with MXM at \( t = 0, 1, 2, 6, 8, 12, 15, \) and 24 h. Phenylbutazone returned the heart rate to baseline by \( t = 2 \) h. Similarly, respiratory rate initially increased 3-fold in placebo-treated horses, and then stabilized at a rate approximately twice baseline (Figure 3B). Meloxicam did not significantly change respiratory rate at any time point, but PBZ resulted in significantly lower respiratory rates at \( t = 2 \) and \( t = 24 \) h.

On completion of the treatment period, 5 placebo-treated horses, 3 MXM-treated horses, and no PBZ-treated horses required rescue analgesia. This was a significant difference between groups in the number of horses requiring rescue analgesia (Chi-square; \( P < 0.05 \)).

Synovitis model
Lipopolysaccharide (LPS) injection induced synovitis accompanied by signs of pain and inflammation in all horses. One of the horses in the SYN group developed a bilateral front limb lameness characterized by sensitivity to hoof testers across the sole between the first and second treatment period. This horse was therefore removed from the study. Thus, the SYN group had 7 horses that completed the trial and only those results are included.

To determine if the horses that received detomidine could be included in the analysis, pre-treatment values at \( t = 0 \) h (2 h post-synovitis induction, but pre-NSAID treatment) for all parameters were compared between those treatment periods where horses received detomidine and those where they did not. Further, the pre-treatment values for all treatment periods in which horses received detomidine were compared to all other treatment periods. No significant differences in any parameter were observed (data not shown), confirming that detomidine did not influence the degree of synovitis induced and was not providing detectable analgesia at \( t = 0 \) h. Therefore, all horses were included in the analysis.

Induction of synovitis was associated with lameness (Synovitis Lameness Score over 2; Table 4), a rise in carpal skin temperature, and variable degrees of joint effusion by \( t = 0 \) h (2 h after joint injection). Synovitis was associated with an increase in the heart rate and respiratory rate (Figures 3C and 3D). In the placebo group, heart rate peaked between \( t = 2 \) and
t = 6 h (4 to 8 h post-joint injection) and returned to baseline by t = 24 h. Neither MXM nor PBZ reduced heart rate compared to the placebo. The respiratory rate peaked at t = 2 h and then returned towards baseline by t = 24 h. Meloxicam significantly reduced the respiratory rate compared to the placebo at t = 2, 4, 12, and 15 h. Phenylbutazone also significantly reduced the respiratory rate compared to the placebo at t = 2 h, but MXM and PBZ were not significantly different at any time point.

The carpal skin temperature peaked at t = 8 h in the placebo group, with an average increase of 5.1 ± 0.8°C above baseline, before starting to decline (Figure 4). Meloxicam significantly reduced the carpal skin temperature increase compared with the
placebo from $t = 6$ to $t = 15$ h and PBZ reduced the temperature increase from $t = 8$ to $t = 15$ h. Phenylbutazone and MXM were not significantly different from each other at any time point.

Lameness scores peaked at $t = 4$ h with the placebo and then began to decrease at $t = 12$ h so that lameness scores were close to baseline by $t = 24$ h (Figure 5). Phenylbutazone did not reduce the lameness score at any time point compared to the placebo, while MXM significantly reduced the lameness score at $t = 12$ and $t = 15$ h. Meloxicam and PBZ were not significantly different at any time point, although the difference did approach significance at $t = 15$ h ($P = 0.10$). An objective assessment of lameness on a continuous scale was achieved using the Lameness Locator® to assess changes in maximum and minimum head height difference during the stride. The maximum head height difference (head height during the impact phase, affected versus non-affected side) increased markedly following induction of synovitis, reaching a peak at $t = 2$ h (Figure 6A). Meloxicam resulted in a significant reduction in the peak increase in maximum head height difference at $t = 2$ h and resulted in a more rapid return towards baseline, with the change in head motion being significantly less than placebo at $t = 4, 6, 8,$ and $12$ h, and significantly less than PBZ at $6$ h. Phenylbutazone only reduced maximum head height compared to placebo at $t = 12$ h. The minimum head height difference (head height during the stance phase) also increased following induction of synovitis, reaching a peak at $t = 2$ h (Figure 6B). Meloxicam significantly reduced the peak change in minimum head height difference at $t = 2, 6,$ and $8$ h compared to the placebo. Phenylbutazone did not significantly alter the minimum head height difference. No horses required rescue analgesia upon completion of any SYN period.

To further confirm that detomidine administration did not affect the results, the complete analysis was repeated excluding the horses that received detomidine. The data trends aligned with the full data set as reported; however, because of the loss of power associated with the decreased number of subjects, only the peak effects of MXM at 6 or 8 h were significant for joint temperature and changes in head height. No significant difference in Lameness Scores was observed at any time point (Figure 7).

**Discussion**

Given the differences in the pathophysiology of mechanical and inflammatory pain and the pharmacodynamic and pharmacokinetic differences between NSAIDs, 2 experimental pain models were used to compare the efficacy of oral MXM and PBZ at the recommended oral doses. Previous studies employing the HBS model typically compared medications over $\leq 13$ h (16,17) and used IV administration. As MXM is typically dosed q24h, these studies were carried out over a 24-hour period. Meloxicam has not previously been assessed in the HBS model. A variety of agents (Freund’s adjuvant, LPS, carrageenan), doses and dose intervals have been used to induce synovitis in horses and there has not been an accepted standard for comparison of NSAID efficacy. It was therefore important to demonstrate efficacy compared to placebo in the pain models as well as the comparative efficacy.

Heart rate and the FLS score are responsive to NSAID treatment in the HBS model (16,17). A TLS using a scoring system based on the descriptors in the FLS was used to ensure a continuous linear scale and to minimize subjective variability between raters by assigning individual scores to each component instead of relying on a single impression score by the evaluator that incorporated all components at once. Furthermore, a behavioral scale (the Global Pain Score) was applied to provide a more global assessment of pain that did not rely solely on lameness. In the HBS model, the increases in heart rate and FLS score in this study were similar to those previously reported (16,17). Oral

---

**Figure 4.** Change in carpal skin temperature of horses relative to baseline ($n = 9$) with LPS-induced synovitis following treatment with placebo, meloxicam, or phenylbutazone. See Figure 1 for full explanation of figure legends.

**Figure 5.** Synovitis lameness scores in horses with LPS-induced synovitis following treatment with placebo, meloxicam, or phenylbutazone. See Figure 1 for full explanation of figure legend.
The prolonged action of PBZ. Thus, PBZ was more effective than MXM in this model of pain, regardless of the assessment parameter considered.

The maximum observable response occurred after the second dose of PBZ. This may reflect a lag time to effect with PBZ, the delay in absorption with oral administration, or a higher plasma concentration achieved after the second dose. Previous studies in the HBS model have used IV administration of PBZ and demonstrated an earlier and greater effect than observed herein (1,16), suggesting that slower time to peak concentrations with oral dosing or the higher plasma concentrations achieved after the second dose are likely more important than a pharmacologic lag time to effect. It would appear prudent to assume a delay in clinical response of at least 4 h following administration of oral PBZ, with the maximum response not occurring until after the second dose at 15 to 24 h.

Over a period of several weeks following completion of the experimental portion of the study, all horses in the HBS group developed evidence of solar necrosis in one or both feet. This has previously been reported (1), but appears to have occurred with a greater frequency in our study. This may be related to the duration of pressure (24 h versus 12 to 13 h more commonly used) or perhaps to a more cranial pressure point of the heart bar shoe. Horses were assessed before each experimental period and solar necrosis or increased sole pain (application of hoof testers) was not observed during the trial. Furthermore, the pressure required to induce pain (as assessed by the number of turns of the screw required to induce pain) was consistent between weeks, even in the instances that the same foot was used for consecutive treatment periods. In other studies, the same foot has been used at more frequent (weekly) intervals (1,16,17). Given that the order of treatment was randomized, alternate feet were used (with a few exceptions) and sole necrosis was not observed during the trial, the occurrence of sole necrosis at a later date does not appear to invalidate the results. It does, however, highlight a limitation of this model.

Overall, these results demonstrate a superior efficacy of oral PBZ compared to oral MXM in a model that primarily induces mechanical pain. The results do not discount the possibility that MXM would be effective for mechanical pain after intravenous injection, at a higher oral dose, or if the pain was less severe.

Intra-articular LPS injection reliably induces a transient joint inflammation and pain that starts within 2 h post-injection and resolves within 24 to 48 h, similar to what was observed in our study (Figures 4–6) (15,22–24). Carpal skin temperature, stride length and lameness scores have been shown to reflect pain and inflammation, and to be responsive to NSAID treatment (25) in SYN models. Instead of stride length, which was found to be variable and difficult to measure in a pilot study, the commercially available Lameness Locator was used to objectively measure changes in head position associated with lameness (26). Joint circumference and joint flexion were also measured, but similar to previous studies (22,25) the results were highly variable and unreliable so they are not reported here.

The time to peak lameness in this study was between t = 2 to t = 4 h (4 to 6 h after injection). The changes in head movement following induction of synovitis were greatest at t = 2 h (4 h after induction), while the peak increase in carpal skin...
temperature was later at $t = 8$ h. These differences to peak times suggest that the measured parameters are reflecting different combinations of pain and inflammation.

Heart and respiratory rate were monitored for untoward systemic responses to LPS. Heart and respiratory rate did increase after induction of synovitis ($P < 0.001$ and $P < 0.02$, respectively), but there was no other evidence of endotoxemia (e.g., hyperemic mucous membranes, elevated temperature). Heart rate and respiratory rate were not reliable indicators of pain in this model as the horses had to be trotted to evaluate lameness and movement of 1 horse disturbed all horses in the barn (note that the HBS model horses were kept in a separate wing).

The ability of PBZ and MXM to ameliorate pain and inflammation in SYN models is consistent with previous reports (23,24). However, no previous studies have directly compared PBZ and MXM in the horse using induced synovitis models. Phenylbutazone and MXM significantly reduced the increase in carpal skin temperature throughout the assessment period compared to the placebo, but were not significantly different from each other (Figure 4). Only MXM significantly reduced the lameness score compared to the placebo, producing significantly lower pain scores at $t = 12$ and $t = 15$ h (Figure 5). By $t = 24$ h, lameness in the placebo group had returned towards baseline so identifying significant changes at that time point was not

---

**Figure 7.** Re-analysis of results, excluding horses receiving detomidine, of assessment of LPS-induced synovitis following treatment with placebo, meloxicam, or phenylbutazone: Synovitis lameness scores (A), change in carpal skin temperature compared to baseline (B), difference in maximum head height (C), and difference in minimum head height (D). See Figure 1 for full explanation of figure legend.
possible. Oral PBZ did not significantly reduce lameness scores compared to the placebo or MXM at any time point. Thus, the subjective lameness scores alone were not able to clearly document differences between PBZ and MXM in the SYN model.

As shown in Figure 6, MXM was more effective than PBZ at reducing SYN associated changes in head movement. There are 2 possible interpretations for the differences between MXM and PBZ in the SYN model. One is that MXM was absorbed more rapidly and achieved effective concentrations in blood and in the joint more quickly than PBZ. An argument against this pharmacokinetic explanation is that MXM and PBZ both maximally reduced carpal skin temperature by t = 8 h and with similar time courses. However, in the HBS model the greatest effects of PBZ on lameness were not observed until t = 15 and t = 24 h, despite reducing heart rate within 1 to 2 h. An alternative and more likely interpretation is that MXM was more effective than PBZ at the doses used and was able to mitigate inflammatory pain earlier in the experimental model, when it was more severe. Regardless of the underlying explanation, MXM had an earlier onset of action in the SYN model compared to PBZ and had the same relative efficacy at t = 12 h. Unfortunately, it is not possible to draw conclusions about relative efficacy after t = 12 h due to waning clinical signs of pain and inflammation.

One concern in this study was the use of detomidine to permit joint injections in 3 horses. The stress of joint injection made these horses difficult to handle, and it was considered an animal welfare and human safety issue to attempt joint injection without sedation. The anti-nociceptive effects of 20 μg/kg BW detomidine are lost in less than 2 h (27), so the lower dose used in this study (~6 μg/kg BW) was not expected to have any effect at the time the NSAIDs were administered (2 h after detomidine). There was no significant effect of detomidine on the pre-treatment values for any of the measured parameters. Furthermore, removal of the horses receiving detomidine from the analysis did not change the overall patterns of response, although statistical power was lost because of the reduced numbers and only MXM produced any significant reductions in the assessed parameters (Figure 7). Therefore, all horses were included in the final analysis.

The results of our study are consistent with the important role of COX-2 in inflammatory pain. Meloxicam and PBZ are both able to inhibit COX-2 and thus reduce peripheral inflammation. Accordingly, both NSAIDs had significant effects in the assayed parameters (Figure 7). Therefore, all horses were included in the final analysis.

The transient induced lameness models used herein decreased variability compared to naturally occurring disease and allowed some distinction between mechanical and inflammatory pain. The use of experimental models allowed a placebo-controlled, cross-over study.

Phenylbutazone was more effective than MXM in controlling the primarily mechanical pain associated with the HBS model, whereas MXM was more effective in the SYN model, which is primarily associated with inflammatory pain at the oral doses used. Our results suggest that oral MXM may be more effective and have a more rapid onset in clinical conditions with a significant inflammatory component, whereas PBZ may be more effective when a significant source of pain is mechanical in origin when using the oral dosage regimen. Naturally occurring MSK conditions typically have a combination of mechanical and inflammatory pain; therefore, clinical response to treatment in individual horses may vary with the relative contributions of mechanical and inflammatory pain. Additional studies in naturally occurring clinical disease could further support the translation of these findings to clinical conditions.

In addition to efficacy, another factor to consider when selecting a NSAID is relative safety. As MXM is COX-2 selective in the horse, it would be anticipated to have a superior gastrointestinal safety profile. Experimental studies suggest that meloxicam may have fewer adverse GI effects than phenylbutazone (31,32).

Meloxicam is not currently approved for use in horses in Canada; however, since PBZ and aspirin are the only oral approved oral NSAIDs for horses in Canada, practitioners are using other NSAID products in an extra-label manner. Use of drugs in an extra-label manner is only appropriate if an approved drug is not suitable for use in a given patient because of administration or dosing challenges, efficacy issues, or safety issues. The results of this study suggest that preference for MXM or PBZ may depend on the specific clinical situation. Meloxicam may be a preferred choice in select clinical cases based on efficacy and safety considerations. It has previously been shown that generic human meloxicam tablets administered in molasses are bioequivalent to the product used in this study (33) and would therefore be expected to produce a similar response.

Acknowledgments

The authors thank Drs. Emma Read and Jerry Bailey for assistance with the intercarpal joint injections. Dr. Jonathan Foreman provided a heart bar shoe prototype so we were able to manufacture our own shoes and provide valuable advice on using the heart bar shoe model. We thank Lisa Colangeli, Kate Armstrong, Wendy Hawes, Danita Phelan, and Sandra Pinkham for technical assistance.

References


Epidemiological study of dogs with otitis externa in Cape Breton, Nova Scotia

Laura R. Perry, Bernard MacLennan, Rebecca Korven, Timothy A. Rawlings

Abstract — From May 2008 to December 2013, 320 cases of otitis externa were diagnosed among 2012 dogs undergoing routine physical examinations at Celtic Creatures Veterinary Clinic, Sydney River, Nova Scotia for a diagnosis frequency of 15.9% [95% confidence interval (CI): 14.3% to 17.6%]. Twenty-four percent of these dogs exhibited 1 or multiple recurrences despite initial treatment with topical antimicrobial/anti-inflammatory solutions. The frequency of diagnosis was significantly higher in breeds with pendulous ears, but was not affected by ear hairiness. There were no seasonal patterns in the frequency of diagnosis. In clinical examination of 60 dogs with otitis externa, bacteria were evident in 47% of infections. Of 10 genera cultured, *Staphylococcus* spp. and diptheroids were most common. In this study, analysis of clinical records provided insights into the local prevalence of otitis externa and the efficacy of treatment in routine clinical situations.

Résumé — Étude épidémiologique des chiens atteints d’une otite externe au cap Breton, en Nouvelle-Écosse. De mai 2008 à décembre 2013, 320 cas d’otite externe ont été diagnostiqués parmi 2012 chiens subissant des examens de routine à la Celtic Creatures Veterinary Clinic, pour une fréquence de diagnostic de 15.9 % (IC de 95 % : de 14,3 % à 17,6 %). Vingt-quatre pour cent des chiens ont manifesté une ou plusieurs récurrences malgré le traitement initial avec des solutions topiques antimicrobiennes/auto-inflammatoires. La fréquence du diagnostic était significativement supérieure chez les races avec des oreilles pendantes, mais elle n’était pas affectée par la présence de poils dans l’oreille. Il n’y avait aucun profil saisonnier dans la fréquence du diagnostic. Dans un examen clinique de 60 chiens avec une otite externe, les bactéries étaient évidentes dans 47 % des infections. Parmi les 10 genres pour lesquels une culture a été réalisée, *Staphylococcus* spp. et les dipthéroïdes étaient les plus fréquents. Dans cette étude, l’analyse des dossiers cliniques a fourni des renseignements sur la prévalence locale de l’otite externe et l’efficacité du traitement des situations cliniques de routine.

(Traduit par Isabelle Vallières)

Can Vet J 2017;58:168–174

Introduction

Otitis externa is an inflammation of the external auditory canal from the pinna to the tympanic membrane commonly observed in canine patients in small animal veterinary practice (1,2). Clinical signs include inflammation, soreness/pain, malodor, discharge, excessive scratching, and head shaking. Chronic cases are those with prolonged clinical signs or progression to closure of the ear canal, production of aural polyps, or rupture of the tympanic membrane, all of which can lead to chronic pain and deafness. Repeated infections can occur during a dog’s lifetime, with the potential for increased severity of infection and development of resistance to antimicrobial treatment when microorganisms are an associated factor (1,3).

Otitis externa has a complex etiology which complicates management of this disease (1,2,4). Primary causes of inflammation include allergies/hypersensitivities, autoimmune diseases, keratinization disorders, and parasites in the ear canal. Progression of this disease can be perpetuated by bacterial and yeast infections. Some bacteria (e.g., *Staphylococcus* spp., *Bacillus* spp.) and yeast are normally present in small numbers in ears of healthy dogs (1,4). When these become numerous or other opportunistic bacteria (e.g., *Pseudomonas* spp., *Escherichia* spp., *Proteus* spp.,...
Coryneform bacteria) colonize the ear, infections may develop and prolong inflammation (1,4–8). Identification of the primary cause(s) of otitis externa is the most critical factor to address in treating otic inflammation, particularly for chronic cases, but this can be challenging (9). Elimination of secondary bacterial or yeast infections via topical antibiotic/anti-inflammatory solutions is also an important and widely practiced therapeutic approach, since elimination of the primary disease without effective management of concurrent infections typically fails to resolve clinical signs (10).

Small animal veterinary practices have valuable information on the frequency of diagnosis of diseases such as otitis externa and on the efficacy of medical treatment in routine clinical situations. Such locally relevant information, however, is often overlooked in favor of larger datasets acquired from veterinary schools [e.g., the Veterinary Medical Data Program (11)] or experimental studies which may bear less relevance to routine procedures followed in veterinary practices. In this study, records from a small animal veterinary practice in Atlantic Canada were examined to assess the seasonal frequency of diagnosis of otitis externa across dog breeds and ear types and to document evidence of recurring infections associated with routine treatment. The relative contribution of yeast and bacteria in otitis externa was also examined given that these are frequently targeted when treating this disease, and bacterial genera associated with local cases were identified.

Two complementary approaches were used in this study. First, an open cohort retrospective analysis of cases of otitis externa diagnosed in a veterinary clinic from 2008 to 2013 was undertaken to assess the frequency of diagnosis, seasonal patterns, and microbial associations with this disease. Second, a prospective analysis of ear swabs of dogs sampled at the clinic was done to verify the relative contribution of bacteria versus yeasts in ear infections and to identify those bacterial groups associated with local cases of otitis externa.

**Materials and methods**

**Veterinary clinic**

Celtic Creatures Veterinary Clinic (CCVC) is an American Animal Hospital Association accredited small animal veterinary hospital in Sydney River, Cape Breton, Nova Scotia, that first opened in 2008 with 1 licensed veterinarian. It now has 2.5 full-time equivalent veterinarians and a caseload of approximately 60% canine, 35% feline, and 5% exotic species. Physical examinations and cytological tests are carried out by licensed veterinarians and registered veterinary technicians, respectively.

**Retrospective study**

Records of dogs from CCVC were compiled from the time the clinic opened in May 2008 to December 2013. As part of routine physical examinations at CCVC, all dogs were initially assessed visually for redness or inflammation of the ear pinna. If any redness, malodor, or abnormal otic exudate was detected or other clinical signs of otitis externa noted or reported by owners, then an otoscopic examination and cytological analysis were performed. A positive case of microbial otitis externa was included in this study if an infectious agent (bacteria/yeast) was present on the cytological examination with at least 3 organisms per field of view (1000× magnification). Because otoscopic examinations were not performed on all dogs that entered the clinic, some cases of otitis externa may have been missed in asymptomatic dogs.

For all positive cases, the date of the infection, infectious agent (yeast, bacteria, or mixed), breed, and age of the dog were noted, we also recorded if and when there was a recurrence. To examine breed-related associations with this disease, we categorized dogs into “breed groupings” based on shared traits (e.g., spaniels, terriers; Supplementary Table 1). Supplementary tables are available on request from the corresponding author. Mongrels included those dogs registered solely as a mixed breed that could not be associated with any breed grouping.

Patterns in diagnosis of otitis externa were investigated over 6 y of records from CCVC by grouping records seasonally and determining the number of dogs with a case of otitis externa divided by the total number of dogs examined in the clinic for that season. Dogs that made repeated visits to the clinic during a season were only counted once within that season, and were scored as positive if otitis externa was diagnosed in at least 1 examination. When a dog made repeated visits to the clinic that spanned different seasons, each seasonal occurrence was entered as a new event. Recurrences were not included in this seasonal analysis: when a dog was found positive for otitis externa, subsequent visits were removed from the dataset (12). We also examined seasonal patterns in the infectious agents associated with otitis externa by determining the percentage of cases associated with bacteria, yeast, or both, within each time period analyzed.

Associations between specific phenotypic traits and the infectious agent linked to cases of otitis externa were explored by categorizing breeds according to ear form (erect versus pendulous) and extent of hair growth around the ear opening (“hairy” versus “not hairy”). Categorization based on ear form and ear hairiness followed the methodology of previous studies (12,13). If a dog was reported with otitis externa more than once, a random number generator was used to select 1 of the multiple entries for inclusion in the dataset to avoid counting repeated infections in the same dog (12).

Recurring cases of otitis externa were defined as those in which a dog that was diagnosed and treated for an otitis externa infection was returned to the clinic after a minimum period of 1 mo with the same clinical signs. To classify as a recurrence, within the period between diagnoses a dog was determined to have “clean” ears on recheck (typically at the 2- or 3-week mark) or through a telephone follow-up call with the owner. Because not all treated dogs returned to the clinic for an otoscopic examination/cytological analysis following initial treatment, it could not be determined if recurrences were associated with new events or were the result of ineffective initial treatment. The percentage of cases of otitis externa associated with recurring infections was calculated by dividing the total number of dogs with recurrences by the total number of dogs with otitis externa over the specified time period. Frequency of recurrences was determined by following the examination history of each dog and noting the number of repeat cases of this disease over
Swab samples were transferred to glass slides for cytology. Slides while minimizing contact with the exterior pinna and hair. tipped swabs placed into the ear canals as deeply as possible clinical signs of unilateral or bilateral otitis externa had cotton bacterial genera associated with these infections. Dogs exhibiting of active canine otitis externa infections at CCVC to identify From May to November 2013, we undertook a prospective study agents (bacteria December 2013. To assess the tendency for recurring infections since there were less than 24 mo to the end of our analysis in analysis did not include infections diagnosed after January 2012, versus yeast), we compared diagnoses with an initial and subsequent infection in the same dog. For dogs with more than 2 infections, each new infection was compared with the diagnosis of the previous infection.

Prospective study
From May to November 2013, we undertook a prospective study of active canine otitis externa infections at CCVC to identify bacterial genera associated with these infections. Dogs exhibiting clinical signs of unilateral or bilateral otitis externa had cotton tipped swabs placed into the ear canals as deeply as possible while minimizing contact with the exterior pinna and hair. Swab samples were transferred to glass slides for cytology. Slides were stained (Dip Quick Stain, JarVet; Jorgensen Laboratories, Loveland, Colorado, USA) and were examined at 1000× magnification. The presence of yeast, bacteria, or a mixed infection was determined for each slide, and the cytological grade reported as in Zur et al (14).

Veterinarian-determined diagnosis of an otitis externa infection was made based on 2 lines of evidence: i) otoscopic examination — presence of inflammation, exudate and the appearance of the tympanic membrane; and ii) the cytology results — the presence of an infectious agent with at least 3 organisms per field of view (1000× magnification). If yeast was the sole infectious agent, this was recorded but the sample was not examined further. If bacteria were present alone or in conjunction with yeast, owners were approached to obtain permission to enroll the dog in the clinical study. All protocols received approval from Cape Breton University’s Research Ethics Board and followed the guidelines of the Canadian Council on Animal Care. Culture swabs (Star Swab II; Starplex Scientific, Etobicoke, Ontario) were taken from the infected ear(s), and streaked onto Columbia agar with 5% sheep blood and onto MacConkey agar, and the plates were incubated at 37°C for 24 to 36 h. After incubation, distinct colonies were sub-cultured to Columbia agar with 5% sheep blood and onto MacConkey agar, and the plates were incubated at 37°C for 24 to 36 h. After which oxidase and catalase tests were performed. With information from these tests, the appropriate diagnostic API strip (API STAPH, API 20E, or API 20NE) (API; bioMérieux Canada, St. Laurent, Quebec) was inoculated and incubated for an overall frequency of diagnosis of 15.9% (95% CI: 14.3% to 17.6%). Cases of this disease spanned 66 breeds, with retrievers (26%), toy breeds (20%), and terriers (12.5%) representing most of the infected dogs. Frequency of diagnosis varied significantly amongst breed groupings (Chi-square, P = 0.028): bulldogs (6/20; 30.0%), schnauzers (4/15; 26.7%), spaniels (22/83; 26.5%), and hounds (14/68; 20.6%) all had disease frequencies > 20%. In contrast, doodles (4/32; 12.5%), long-hairs (18/153; 11.8%), and mixed breeds (4/52; 7.7%) had the lowest values (≤ 12.5%). With respect to individual breeds, in which sample sizes per breed were ≥ 15 dogs, springer spaniels, miniature poodles, Shetland sheepdogs, cocker spaniels, and Siberian huskies had the highest frequencies of diagnosis reaching > 20%; in contrast, collies, mixed breeds, bull terriers.

Results
Over 6 y at CCVC, 320 dogs were diagnosed with at least 1 event of otitis externa infection out of 2012 dogs examined, for an overall frequency of diagnosis of 15.9% (95% CI: 14.3% to 17.6%). Cases of this disease spanned 66 breeds, with retrievers (26%), toy breeds (20%), and terriers (12.5%) representing most of the infected dogs. Frequency of diagnosis varied significantly amongst breed groupings (Chi-square, P = 0.028): bulldogs (6/20; 30.0%), schnauzers (4/15; 26.7%), spaniels (22/83; 26.5%), and hounds (14/68; 20.6%) all had disease frequencies > 20%. In contrast, doodles (4/32; 12.5%), long-hairs (18/153; 11.8%), and mixed breeds (4/52; 7.7%) had the lowest values (≤ 12.5%). With respect to individual breeds, in which sample sizes per breed were ≥ 15 dogs, springer spaniels, miniature poodles, Shetland sheepdogs, cocker spaniels, and Siberian huskies had the highest frequencies of diagnosis reaching > 20%; in contrast, collies, mixed breeds, bull terriers.
golden doodles, bichon frises, pomeranians, and miniature dachshunds appeared less prone, with <10% of dogs having infections. Miniature dachshunds were the only breed examined in which no cases of otitis externa were reported (0/15). German shepherds had a frequency of diagnosis of 14.3% over 105 dogs examined.

There was no significant association between ear hairiness and the frequency of otitis externa (hairy 15.7%; not hairy 16.5%; Chi-square, \( P = 0.64 \)); however, dogs with pendulous ears were diagnosed significantly more frequently (17.8%) compared with those with erect ears (12.8%; Chi-square, \( P < 0.001 \); Figure 1).

The annual incidence of otitis externa increased over our sampling period (Figure 2), reaching a high of 16.7% in December 2013 — the last period sampled. No significant differences were found in incidence levels across the 4 seasons (Kruskal-Wallis, \( P = 0.92 \)); the average seasonal incidence was 7.7% (95% CI: 6.4% to 9.0%). Infectious agents were recorded in 89% (284/320) of the 320 clinical records at the time of diagnosis; in the remaining 36 cases, otitis externa was diagnosed, but the microbial association (bacterial, yeast, or mixed) was not specified in the clinical record. Based on complete records, yeasts were associated with the majority of infections (82.0%), either as sole or mixed infections. The relative frequency of occurrence of bacteria and yeast in otitis externa cases varied dramatically across sampling periods, but no consistent seasonal trends were apparent (Figure 3; Kruskal-Wallis, \( P = 0.61 \)). Bacteria-associated infections (either bacteria or mixed) accounted for more than 37.5% of otitis externa cases in every season except spring 2010, and in 6 separate seasons, bacteria were associated with \( \geq 75\% \) of infections.

The proportion of yeast, bacteria, or mixed infections did not differ significantly between dog breeds based on ear form, with bacteria associated with 54.5% and 59.1% of pendulous and erect eared dogs, respectively (Chi-square, \( P = 0.75 \)). Likewise, no significant association was found based on ear hairiness (52.1% versus 59.6% for hairy/not hairy ears, respectively; Chi-square, \( P = 0.21 \)).

Seventy-eight dogs (24% of infected dogs) returned to the clinic with otitis externa once or multiple times during the course of the study despite initial treatment with a variety of topical antimicrobial/anti-inflammatory solutions. Most of these cases represented a single event, although as many as 4 recurring infections were documented in 2 dogs (Figure 4a). Return visits occurred most often in cases associated with yeast infections (25.6%), but were also high in mixed (21.4%) and bacterial infections (20.0%). The incidence of recurring infections was highest in dogs sampled during the first 2 y of the study (39% and 42%, respectively), reflecting the longer period over which recurrences could occur in these dogs relative to those examined during the latter part of the study. When analyzed over a 2-year sliding window, recurrences were more likely to occur within the 7- to 12-month time frame following initial diagnosis, with declining incidence after 1 y (4b). Recurring infections were significantly more likely to be associated with the same infectious agent as the initial infection for both bacterial (Chi-square, \( P = 0.009 \)) and yeast-based cases (Figure 5; Chi-square, \( P = 0.003 \)) of otitis externa, but not for mixed cases (Chi-square, \( P = 0.30 \)). Neither ear type nor ear hairiness was associated with an increased frequency of recurring infections over the 6-year study period (ear type: Chi-square, \( P = 0.94 \); ear hairiness: Chi-square, \( P = 0.46 \)).

Prospective study

Sixty dogs with otitis externa spanning 21 breeds entered our prospective study from May to November 2013. Based on culture and cytology, 28 (47%) of these were positive for bacterial or mixed infections, whereas 32 had yeast alone. In total, 48 distinct types of bacterial colony representing 10 genera were isolated from the 28 dogs with bacteria/mixed infections. *Staphylococcus* was the most common bacterial genus (36% of cases), followed by the diptheroid group (23%). *Klebsiella* spp.
and *Proteus* spp. were both isolated from 8% of the cultures, and *Pseudomonas* sp. was found in 6%. Other bacteria were grouped together as other Gram-positive bacteria, including *Micrococcus* spp. and *Kocuria* spp. and other Gram-negative species, consisting of *Pantoea* spp., *Escherichia* spp. and *Weekella* spp. which made up 8% and 11% of the isolated cultures, respectively. The diptheroids were never isolated on their own. They were always found in conjunction with other bacteria.

Cytological analyses of the ears of the 10 control dogs revealed that 6 were positive for yeast, 3 were positive for bacteria, and 1 did not have any bacteria or yeast detected. Three bacterial genera were isolated from healthy ears: *Staphylococcus* spp., *Bacillus* spp., and a *Streptococcus* spp.

**Discussion**

With a diagnosis frequency of 15.9% among 2012 dogs examined over 6 y at CCVC, the results fall within the commonly cited 5% to 20% prevalence range for otitis externa (1,3,4,8,14,16). These high values underscore the importance of otitis externa in dogs (1). The increase in incidence of otitis externa over the 6-year study period at CCVC may be due to increased vigilance associated with 2 new veterinarians who joined the practice in Spring, 2010 and Fall, 2013.

Otitis externa is not evenly distributed across all canine breeds. Factors that predispose dogs to developing otitis externa include shapes of the ear canal and pinna, excessive moisture in the ear canal, and trauma to the ear due to excessive cleaning (12,14,17,18). Higher incidence of otitis externa is often reported in specific breeds of dogs (e.g., poodles, cocker spaniels, Brittany spaniels, Labrador retrievers, shar-peis, and German shepherds) that tend to have abnormalities of the ear, allergies, keratinization disorders, and hyperactive ceruminous glands (3,14,16,18,19). Our results documented the highest frequencies of diagnosis in springer and cocker spaniels, miniature poodles, Shetland sheepdogs, and Siberian huskies, a result not entirely consistent with other studies. Particularly unexpected was the relatively low frequency of otitis externa in German shepherds, since this breed is well-known for hyperactivity of its cerumen-producing glands (1,18).

Breeds with pendulous ears were associated with a higher frequency of otitis externa relative to breeds with erect ears in our study, although ear hairiness was not. These results corroborate, at least in part, the findings of Hayes et al (12) who first documented a significantly higher risk of otitis externa in dogs with hairy, pendulous ears. These ear traits may increase disease risk by affecting air flow, heat radiation, and convection from the ear canal relative to erect, hair-free ears, providing conditions ideal for microorganism growth. Contrary to expectation, however, Huang and Huang (13) did not find elevated external ear temperatures in dogs with hairy or pendulous ears. Higher frequencies of otitis externa in hairier ears have been linked to matted hair in the ear canal (5), entrapment of grass awns causing irritation and inflammation (19), and increase in ceruminous and sebaceous gland tissue (20).

Few studies have examined seasonal changes in the incidence of otitis externa, yet ambient temperature and humidity can result in subtle but important changes in the microenvironment of the ear (12,21,22). Using records from veterinary medical teaching hospitals in the US, Hayes et al (12) documented higher rates of diagnosis in the late summer and fall, and found that air temperature, rainfall, and relative humidity (with a 1- to 2-month lag) explained a substantial amount of variation in the hospital prevalence of first diagnosed cases at each hospital location. While our qualitative analysis noted changes in the incidence of otitis externa and type of microorganisms associated with otitic ears across seasons and years, there was no consistent...

---

Figure 3. The percentage of cases of otitis externa diagnosed each season (from 2008 to 2013) that were associated with bacterial, yeast, or mixed (bacterial and yeast) infections. Values are expressed as percentages due to the varying number of cases each year.
pattern or significant seasonal effect. A more detailed analysis of canine lifestyles and activity patterns across seasons in Cape Breton (19) in the context of seasonal variation in weather may help to understand these results more fully.

Approximately 1 in 4 dogs diagnosed with otitis externa in our study experienced recurring clinical signs following initial treatment. The potential for recurrence is likely even higher than this, given that ~40% of dogs that entered our study in the first 2 y returned with otitis externa over the subsequent 4 to 5 y of records. Recurrences could reflect a number of factors, including the use of ineffective medications, the presence of microbe strains resistant to topical antibiotics/antifungals, or poor owner compliance. Failure to treat the primary cause(s) of otitis externa, which is critical to resolving ongoing inflammation in the ear canal, could contribute to the potential for this disease to recur (2,9). Determination of primary causes is often bypassed in routine treatment of otitis externa in an effort to quickly alleviate clinical signs and suffering that arise with microbial infections. The high frequency of recurrences documented herein, however, suggests that increased emphasis should be placed on addressing primary causes, particularly for chronic cases of this disease. For an affected individual, this will involve a thorough history and assessment of lifestyle and diet, a physical and dermatological examination, and an understanding of specific breed-related predispositions to this disease (9,14,19).

Treatment of microbial infections remains an important short-term therapeutic objective in alleviating clinical signs of otitis externa. Both bacteria and yeast were associated with otitis externa in our study, with both pure and mixed infections of each. Bacteria cultured from dogs with otitis externa at CCVC were similar to genera found in past investigations; however, differences were evident in the prevailing genera. The common presence of *Staphylococcus* spp. was consistent with the literature (4,6,8,14,18); however, we reported a higher incidence of diptheroids (23% of cases) compared with most other studies (4,18; 1.2%, and 10.3% of dogs, respectively). In addition, previous studies documented higher incidences of *Pseudomonas* spp. (7% to 35.5%; 4,6,7,23) compared with 6% herein. Regarding control dogs, the 3 genera of bacteria and yeast we documented have also been reported in controls of another study (4).

Identification of bacterial cultures was restricted to the genus level, given that API strips do not accurately identify organisms from veterinary origin to species level (24–26). Identifying bacterial species to test their resistance to antibiotics commonly used to treat otitis externa would provide additional insights in local cases. Post-treatment evaluation of the otic inflammation is the most certain way to determine success of a treatment rather than in vitro analysis of bacterial isolates and susceptibility patterns (2,9). However, in vitro studies remain beneficial for selecting the optimal medication for treating the infection, especially in cases in which empirical treatment is unsuccessful (4,6,8,9,18,27).

The treatment of diseases with complex etiologies such as otitis externa may benefit from the careful examination of clinical records from veterinary practices. Disease prevalence can vary temporally and geographically, as can the prevalence of bacteria and yeast species associated with otitis externa and their susceptibility to antimicrobial/antifungal agents. Bacterial strains can also be expected to change through time in response to selective pressure through use of topical antibiotics and fungicides (7,8,23,28). In Canada, there have been relatively few recent surveys of the diversity and susceptibility of bacterial species associated with otitis externa (6), and while there is general consistency in the common bacteria present (5,6, our study), there are differences in prevalence as well as in resistance to antibiotics. Knowledge of the microbial species present locally and their susceptibility to specific antibiotics should facilitate...
more effective treatment and reduce the likelihood of chronic cases or the emergence of antibiotic-resistant bacteria.

Working with datasets from small animal veterinary practices can have substantial challenges and limitations that should be considered in future studies undertaking similar approaches. In small start-up practices such as CCVC, there can be inconsistencies in record-keeping until standard methodological approaches have been developed. Such issues are not unique to small animal practices, however, and can also be a problem in larger retrospective datasets (11). In addition, datasets sampled from veterinary practices can be informative and can reflect the need for changes in the laboratory, the staff of Celtic Creatures Vet Clinic, Dr. David McCorquodale and Dr. Robert Bailey at Cape Breton University for their support of this project, and Matt Saab and Dr. Anne Muckle for their comments and suggestions on the manuscript. We also notably appreciate the comments of the two anonymous reviewers who helped to improve the manuscript considerably. We acknowledge IDEXX Laboratories for donating clinical supplies and NSERC for supporting LP through an Industrial USRA.

Acknowledgments

We thank Lillian Kelly for her assistance and invaluable experience in the laboratory, the staff of Celtic Creatures Vet Clinic, Dr. David McCorquodale and Dr. Robert Bailey at Cape Breton University for their support of this project, and Matt Saab and Dr. Anne Muckle for their comments and suggestions on the manuscript. We also notably appreciate the comments of the two anonymous reviewers who helped to improve the manuscript considerably. We acknowledge IDEXX Laboratories for donating clinical supplies and NSERC for supporting LP through an Industrial USRA.

References

Effect of pre-warming on perioperative hypothermia and anesthetic recovery in small breed dogs undergoing ovariohysterectomy

Turi K. Aarnes, Richard M. Bednarski, Phillip Lerche, John A.E. Hubbell

Abstract — This study compared perianesthetic body temperatures and times to recovery from general anesthesia in small dogs that were either warmed for 20 minutes prior to anesthesia or not warmed. Twenty-eight client-owned dogs that were presented for ovariohysterectomy were included in the study. Small (<10 kg body weight) dogs with normal circulatory status were randomly assigned to receive pre-warming for 20 minutes or no treatment. Body temperature was measured during the procedure using a calibrated rectal probe. Duration of anesthesia and surgery, time to rescue warming, time to extubation, presence and duration of shivering, and time to return to normal temperature were recorded. Temperature at the end of surgery was significantly higher in the control group than the pre-warmed group. There was no difference in time to extubation or duration of postoperative shivering between groups. Pre-warming did not result in improved temperature or recovery from anesthesia.

Résumé — Effet du préchauffement sur l’hypothermie périopératoire et le réveil après l’anesthésie chez des chiennes de petites races subissant une ovario-hystérectomie. Cette étude a comparé les températures corporelles perianesthésiques et la durée du réveil après l’anesthésie générale chez des petites chiennes qui étaient soit réchauffées pendant 20 minutes avant l’anesthésie ou non réchauffées. Vingt-huit chiennes appartenant à des clients qui ont été présentées pour l’ovario-hystérectomie étaient incluses dans l’étude. Les petites chiennes (< 10 kg de poids corporel) avec un état circulatoire normal ont été assignées au hasard pour recevoir le préchauffement de 20 minutes ou aucun traitement. La température corporelle a été mesurée durant l’intervention à l’aide d’une sonde rectale calibrée. La durée de l’anesthésie et de la chirurgie, le temps jusqu’au réchauffement de secours, le temps jusqu’à l’extubation, la présence et la durée des frissons et le temps jusqu’au retour à la normale ont été consignés. La température à la fin de la chirurgie était significativement supérieure dans le groupe témoin comparativement au groupe préchauffé. Il n’y avait aucune différence au niveau du temps jusqu’à l’extubation ni de la durée des frissons postopératoires entre les groupes. Le préchauffement n’a pas amélioré la température ni le réveil après l’anesthésie.

Introduction

Hypothermia is the most common anesthetic complication in dogs and cats, occurring in approximately 40% of anesthetized animals (1). Hypothermia can be detrimental to overall outcomes because it causes or contributes to sympathetic activation, pharmacokinetic alterations, coagulation abnormalities, blood loss, cardiac morbidity, wound infection, and shivering. Factors contributing to perioperative hypothermia are convection, conduction, radiation, evaporation, intravenous fluid administration, cold and dry inhaled gases, and patient surgical preparation using cold solutions (2). Anesthesia inhibits both heat-seeking behaviors and activities that cause heat production (movement and shivering), and some anesthetic drugs cause vasodilation, which could contribute to heat loss, although this loss is minimal compared with losses due to blood redistribution (3). Anesthetics also interfere with or inhibit thermoregulation through inhibition of vasoconstriction (2). Hypothermia develops in 3 phases: i) redistribution of core heat to body surfaces during anesthetic-induced inhibition of tonic thermoregulatory vasoconstriction causes core temperatures to

Department of Veterinary Clinical Sciences, College of Veterinary Medicine, The Ohio State University, 601 Vernon L. Tharp Street, Columbus, Ohio 43210, USA.
Address all correspondence to Dr. Turi Aarnes; e-mail: Aarnes.1@osu.edu
Dr. Hubbell’s current address is Rood and Riddle Equine Hospital, Lexington, Kentucky 40580, USA.
Funding for the study was provided by the Paladin Research Fund of The Ohio State University College of Veterinary Medicine. The project was also supported by grant number UL1TR001070 from the National Center for Advancing Translational Sciences.
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 purpose of this study was to compare body temperature in small dogs that were pre-warmed for 20 min before general anesthesia and abdominal surgery to body temperature in small dogs that were not pre-warmed. Additionally we wanted to compare recovery times in these dogs. It was hypothesized that pre-warming small breed dogs would result in higher postoperative temperatures compared to dogs that were not pre-warmed and that pre-warmed dogs would recover faster from general anesthesia.

Materials and methods

Dogs
This was a randomized, controlled prospective clinical study that was approved by the Clinical Research Advisory Committee of The Ohio State University College of Veterinary Medicine. Owner consent was obtained before enrollment in the study. The study population consisted of 28 dogs that were presented to The Ohio State University Veterinary Medical Center for ovariohysterectomy. A physical examination was performed on each dog before inclusion in the study, and packed cell volume and serum total solids were also obtained for each patient. Dogs were included in the study if they were < 10 kg body weight. Exclusion criteria included clinical dehydration (hemocentration, skin tenting, mucous membrane examination), cardiac disease (previous diagnosis, heart murmur greater than grade II/VI), and any condition that precluded the use of the standardized anesthetic protocol.

Dogs were randomly assigned to a study protocol consisting of the following groups: Group C — no pre-warming or Group P — pre-warming for 20 min.

Study design
Baseline body temperature was measured using a rectal thermometer probe (YSI 2100 Temperature Probe; YSI, Yellow Springs, Ohio, USA) the morning of surgery during the preoperative physical examination. The thermometer was calibrated before initiation of the study. A pre-determined pre-anesthetic, induction, and maintenance drug protocol suitable for young, healthy dogs was used in all dogs. Acepromazine (Vedco, St. Joseph, Missouri, USA), 0.05 mg/kg body weight (BW), and buprenorphine (Reckitt Benckiser, Hull, England), 0.01 mg/kg BW, were administered intramuscularly (IM). Dogs were then placed in an infant incubator (DRE Infancia NB1, Louisville, Kentucky, USA) with dimensions of 108.5 cm × 64.0 cm × 90.0 cm, with the warming source turned off. Dogs were housed in this incubator for 20 min to allow the pre-anesthetic drugs to take effect.

After 20 min, an IV catheter was placed in a cephalic vein and rectal temperature was measured and recorded. Dogs in Group C were placed in the incubator without the heating unit turned on. Dogs in Group P were placed in a heated incubator for 20 min with the internal temperature set to 43°C. A thermometer was placed in the incubator for 20 min to allow the pre-anesthetic drugs to take effect.

Data are presented as mean ± standard deviation. a Value is significantly different from the other treatment.
placed in the incubator to measure ambient temperature. After 20 min the dogs were removed from the incubator.

Propofol (Abbott Laboratories, North Chicago, Illinois, USA), 4 mg/kg BW, IV, was administered within 5 min of removal from the cage. Dogs were intubated and maintained with isoflurane in 100% oxygen at the lowest vaporizer setting that provided an appropriate anesthetic depth. A non-rebreathing anesthetic circuit with the oxygen flow rate set at 200 mL/kg BW per minute was used for all dogs. Dogs received room temperature intravenous fluids (lactated Ringer’s solution) at a rate of 5 mL/kg BW per hour from the time of induction until the end of anesthesia. Heart rate was determined using a Doppler ultrasound (Parks Medical Electronics, Aloha, Oregon, USA) with the Doppler probe placed over the palmar digital artery. Heart rhythm was monitored using an electrocardiogram. Respiratory rate was determined by visualizing movement of the reservoir bag. Arterial blood pressure was estimated using the Doppler, an appropriately sized blood pressure cuff, and a sphygmomanometer. Potential intraoperative complications, such as bradycardia (defined as a heart rate of 60 beats/min or lower) or hypotension (defined as a systolic arterial blood pressure of 80 mmHg or lower) were treated as deemed appropriate by the supervising anesthesiologist. Rectal temperature was monitored continuously (YSI 2100) and recorded every 5 min. While in the surgery room, dogs were placed on a thermal warming system (Gaymar Stryker T/Pump; Stryker, Orchard Park, New York, USA) and covered with a blanket that was not operative initially. The thermal warming system was turned on to a temperature of 42°C if the rectal temperature fell to 35°C during the surgical procedure, and the time was recorded.

At the end of surgery dogs were transferred to a recovery room. If body temperature at the end of surgery was lower than 36.7°C, dogs were rewarmed following surgery using a forced warm air blanket set to the “high” setting (43°C) and covered with a medium weight pad or by placing them in a heated incubator set to 43°C.

The following were recorded:

- baseline temperature (the morning of surgery);
- incubator temperature;
- time interval from induction of anesthesia [defined as the time of propofol administration until the dog was moved into the operating room (OR)], (defined as the time of temperature probe placement in the OR);
- abdominal preparation time (clipping and scrubbing in the pre-surgical area);
- ambient temperature in the OR;
- first temperature in the OR;
- temperature at the start of surgery (defined as the time of initial skin incision);
- time interval from anesthetic induction to start of surgery;
- time interval from moving into the OR to start of surgery;
- time interval from anesthetic induction to rescue warming;
- time interval from start of surgery to rescue warming;
- duration of surgery;
- duration of anesthesia (defined as the time from start of isoflurane administration to the time the isoflurane vaporizer was turned to the off position);
- rectal temperature at the end of surgery (defined as the time at which the last suture was placed);
- time interval to extubation (defined as the time from the end of surgery to the patient swallowing and removal of endotracheal tube); and
- duration of shivering were recorded.

Pain was assessed in the immediate perioperative period and treated as deemed appropriate by the supervising anesthesiologist. Postoperative pain was treated by the attending surgeon using non-steroidal anti-inflammatory drugs and/or opioids.

**Analysis of data**

All data were normally distributed (D’Agostino & Pearson omnibus normality test) and were analyzed using an unpaired one-tailed t-test. Values of $P < 0.05$ were considered significant. All data are reported as mean ± standard deviation (SD).

**Results**

Sixteen breeds were represented in this study, including 5 mixed-breed dogs, 4 Jack Russell terriers, 3 toy poodles, 2 Cavalier King Charles spaniels, 2 Yorkshire terriers, 2 miniature schnauzers, and 1 dog each for 10 other breeds (French bulldog, English bulldog, Chihuahua, miniature pinscher, miniature dachshund, papillon, Shetland sheepdog, Havanese, Alaskan klee kai, and Pembroke Welsh corgi). All dogs were female and were anesthetized for ovariohysterectomy. There were 14 dogs in each group.

Dogs in group P ranged in age from 6 mo to 7 y and weighed 4.4 ± 2.2 kg, and dogs in group C ranged in age from 5 mo to 5 y and weighed 5.8 ± 2.0 kg. There was no difference in baseline rectal temperature taken on the morning of surgery. The incubator temperature for group C was 22.5°C ± 1.6°C and the incubator temperature for group P was 37.9°C ± 1.7°C.

There was no significant difference in preparation time, time from anesthetic induction to moving to the operating room, ambient temperature in the operating room, first rectal temperature in the OR, or rectal temperature at the start of surgery. The time from anesthetic induction to the start of surgery in group C was significantly shorter at 30 ± 5 min, compared with group P for which it was 37 ± 9 min ($P = 0.0167$), but there was no difference between groups in time from anesthetic induction or start of surgery to rescue warming or in time from moving to the operating room to start of surgery. All dogs in group P and 13 of 14 dogs in group C required rescue warming. There was no difference in duration of surgery or duration of anesthesia between groups. The temperature at the end of surgery was significantly lower in the group P dogs (34.0°C ± 1.0°C) compared with group C dogs (34.7°C ± 1.2°C) ($P = 0.0273$).

One dog in each group was treated for intraoperative bradycardia by administration of an anticholinergic. No other complications were noted in the pre-warmed group. In the control group, 2 dogs were sedated with acepromazine in recovery (following extubation) due to emergence delirium, and 1 dog was noted to have occasional ventricular premature complexes during anesthesia that were not treated and resolved during the anesthetic period.
The mean ± SD time to extubation was 9 ± 3 min for pre-warmed dogs and 8 ± 5 min for the control group. Shivering occurred in 13 dogs that were pre-warmed and 11 dogs in the control group. Duration of shivering was 42 ± 24 min in the pre-warmed group and 31 ± 23 min in the control group. There were no differences between groups in any of these variables.

**Discussion**

Pre-warming dogs before induction of general anesthesia in this study did not result in decreased incidence of perioperative hypothermia. All dogs in this study developed hypothermia regardless of treatment group. These results are consistent with those of Rigotti et al (20), who evaluated the effect of pre-warming for an unspecified duration before anesthesia for minor surgical or diagnostic procedures.

In contrast, pre-warming for 20 to 30 min has been shown to decrease incidence of perioperative hypothermia in dogs premedicated with acepromazine or dexmedetomidine (19) and pre-warming for 20 min decreased the incidence of perioperative hypothermia by 62% in adult humans (11), even though in both of these studies, intraoperative warming was not instituted until body temperature decreased to 36°C. It is possible that body surface area in our study was a limiting factor. Dogs weighing < 10 kg were used in Rigotti's study (20), whereas the size of the dogs in Read's study was not specified (19).

Pre-warming may have resulted in peripheral vasodilation causing increased heat loss due to redistribution hypothermia (12). Body temperature after pre-warming just prior to anesthetic induction was not checked so as not to cause excitement or anxiety before administration of anesthetic induction drugs. This is a limitation of this study as starting temperatures of these patients before movement into the OR approximately 15 to 18 min later are not known. Subjectively, dogs in the pre-warmed group were panting during the 20 min of pre-warming, but this does not necessarily equate to an overall increase in body temperature. Heat loss occurs in different phases, with the redistribution phase occurring within the first hour of general anesthesia (2–4). Vasodilation has also been demonstrated to occur in awake humans after forced warming and persists for the duration of warming (12). It is unknown what effect warming followed by withdrawal of warming has on vascular tone. Additionally, acepromazine and isoflurane, both of which cause vasodilation, may have exacerbated the peripheral vasodilatory effect of pre-warming.

There was a slightly longer time to start of surgery (defined as the time interval from anesthetic induction to start of surgery) in the pre-warmed group compared to the control group, but there was no difference in time interval from anesthetic induction to the operating room, in time interval from anesthetic induction or start of surgery to rescue warming, or in overall duration of surgery. This slightly longer time to surgery is unlikely to have affected anesthetic recovery or the incidence of perioperative hypothermia.

Rescue warming was initiated when rectal temperature dropped to 35°C, as in studies by Horn et al (21) and Rigotti et al (20). All dogs in the pre-warming group, and all but 1 in the control group required intraoperative warming with no difference in time to initiation of preoperative warming. However, dogs in the control group were significantly warmer at the end of surgery than were dogs that received pre-warming, suggesting that the dogs in the control group either had improved thermoregulation or were able to maintain core body temperature better than the pre-warmed dog group. There was no difference in extubation time or shivering between groups; dogs were extubated 8 to 9 min following cessation of inhalant administration regardless of the group.

A limitation of the present study was the use of a non-rebreathing system, which could have resulted in lower rectal temperatures due to the associated high fresh gas flow. It is possible that body temperature in both groups would have been higher if a rebreathing circuit was used; however, Kelly et al (22) demonstrated no temperature difference related to circuit type.

We chose to standardize the breathing circuit in all dogs and use of non-rebreathing circuits varies with weight of the dog. There is no body weight limit for use of a re-breathing circuit, but non-rebreathing circuits have a history of being used in dogs weighing less than 5 kg (23).

Another limitation of this study is that patients didn't receive any warming during the anesthetic period. Pre-warming before and after epidural block before induction of general anesthesia has been demonstrated to prevent perioperative hypothermia in humans (21). In this study all patients received intraoperative warming. The use of intraoperative warming did not prevent the development of perioperative hypothermia. We chose to pre-warm patients before induction, but did not warm during surgery unless the temperature fell to 35°C in order to establish the effects of 20 min of pre-warming on intraoperative temperature and recovery from anesthesia. Additional studies to determine if pre-warming along with intraoperative warming modalities would have prevented or prolonged the development of intraoperative hypothermia are warranted though studies on peripheral skin warming have indicated that warming of the extremities may be more beneficial for maintaining body heat in dogs (24).

In conclusion, pre-warming small dogs for 20 min before induction of general anesthesia did not reduce the incidence of perioperative hypothermia or improve recovery time, and may have resulted in decreased body temperatures in these dogs.

**Acknowledgments**

The authors thank Kathleen Bailey, RVT; Heather Cruea, RVT, VTS (Anesthesia/Analgesia); Theresa Hand, RVT; Gladys Karpa, RVT; Mary Beth Morrow, RVT; Amanda Spires, RVT; Robyn Victorine, RVT; and Dan Wallon, RVT for technical assistance.

**References**

Computed tomographic measurement of canine urine concentration

Allison L. Zwingenberger, Danielle D. Carrade Holt

Abstract — Computed tomography (CT) is able to measure the attenuation of urine in Hounsfield units (HU) on abdominal imaging studies. This study was designed to measure the correlation of urine attenuation with urine specific gravity in urine samples of 40 dogs, providing a noninvasive measure of urine concentration. The HU of urine explained 72% of the variance in measured urine specific gravity \( R^2 = 0.72, F(1,38) = 95.55, P < 0.001 \). This noninvasive measurement can be used to estimate urine concentration in dogs undergoing abdominal CT imaging.

Résumé — Mesure de la concentration de l’urine canine par tomodensitométrie. La tomodensitométrie (TO) peut mesurer l’atténuation de l’urine en unités Hounsfield (UH) dans des études d’imagerie abdominale. Cette étude a été conçue pour mesurer la corrélation de l’atténuation de l’urine avec la gravité spécifique de l’urine dans des échantillons d’urine de 40 chiens, ce qui a fourni une mesure non invasive de la concentration de l’urine. Les UH de l’urine ont expliqué 72 % des variances dans la gravité spécifique de l’urine mesurée \( R^2 = 0.72, F(1,38) = 95.55, P < 0.001 \). Cette mesure non invasive peut servir à estimer la concentration de l’urine des chiens subissant une imagerie abdominale réalisée par tomodensitométrie.

Can Vet J 2017;58:180–182

Urine specific gravity is a common laboratory test performed to evaluate polyuria, hydration status, and renal function. Urine specific gravity is an estimate of osmolality, which evaluates the ability of the renal tubules to concentrate urine by active reabsorption (1). The specific gravity of a dog’s urine is most commonly determined using a refractometer. Testing urine specific gravity requires a urine sample collected by free catch, catheterization, or cystocentesis. Specific gravity is highly correlated to water content of substances (2) and has been shown to correlate with the computed tomographic (CT) measurement of urine attenuation using Hounsfield units (HU) in humans (3). Animals undergoing CT of the abdomen have quantitative imaging data collected about urine attenuation of X-ray beam during the study. This noninvasive measure of urine attenuation might be correlated to urine specific gravity in dogs and could provide quantitative information about urine concentration during imaging studies.

A surrogate method of measuring urine specific gravity could facilitate studies in which urine samples were not collected, or to perform urinalysis at the same time as imaging. We hypothesized that urine attenuation measured by CT is correlated to urine specific gravity in dogs.

Urine samples collected for routine clinical use, submitted to the VMTH Clinical Diagnostic Laboratory, were used for this study, thus additional IACUC approval was not required. Urine samples were centrifuged at 335 \( \times \) g for 6 min. Specific gravity of the urine supernatant was determined using a refractometer (Reichert Vet 360; Reichert Analytical Instruments, Depew, New York, USA). All urine samples underwent sediment analysis for presence of lipid and to confirm presence of red blood cells. Other tests, performed on unspun urine, included pH and presence of protein, glucose, ketones, bilirubin, lipid, and hemoprotein (Chemstrip 10 UA; Roche Diagnostics, Indianapolis, Indiana, USA; Roche Urisys 1800 analyzer; Roche Diagnostics). The supernatant was stored in glass/plastic tubes at 4°C prior to CT imaging. Urine samples were placed in plastic racks that did not produce beam hardening during imaging.

Urine samples were imaged within 24 h of collection. The urine samples were imaged on a 16-slice clinical CT scanner (Lightspeed16; General Electric, Milwaukee, Wisconsin, USA) at 120 kV, 100 mA, and 0.625 mm collimation and were reconstructed in a high frequency algorithm. The first 20 samples were scanned a second time after inverting each tube 5 times to suspend any dependent particles. Regions of interest (ROI) were drawn on the center of the urine in each tube with an approximately standard size, avoiding partial volume artifacts.
from the walls of the tube (Osirix 64 bit v. 6.0; Pixmeo, Bernex, Switzerland). The mean HU of the ROI was recorded for each sample.

The HU of the inverted and non-inverted samples were compared with paired t-tests. Linear regression was used to evaluate the correlation of urine specific gravity and urine HU. Spearman correlation tests were used to determine whether urine solutes affected the HU measurement.

Forty consecutive canine urine samples were obtained for CT imaging. The mean age of the dogs was 8.6 y (± standard deviation (SD) 3.2 y), and mean weight was 22.6 kg (± 15.2 kg). The gender distribution was 1 female, 15 female spayed, 4 male, and 20 male neutered dogs. A variety of breeds were represented, including 31 purebreeds and 9 mixed breed dogs. Fifteen dogs were presented for signs referable to the urinary tract, and 25 dogs had medical conditions unrelated to the urinary tract.

The mean HU of the urine samples was 35.6 (± 16.3; range: 7.9 to 72.2), the mean specific gravity of the samples was 1.030 (± 0.0133; range: 1.007 to 1.057), and the mean pH of the urine was 6.75 (± 1.0; range: 5 to 9). Twenty-eight of 40 (70%) dogs had no or trace proteinuria, and 12/40 (30%) had moderate to high proteinuria. Seven of 40 (17.5%) dogs had ketonuria, and 16/40 (40%) had bilirubinuria. Twenty-eight of 40 (70%) dogs had hemoproteinuria. Twenty-three of 40 (57.5%) dogs had lipiduria. No dog had glucosuria.

Inversion of the samples did not result in significant alteration of the measured urine HU (P = 0.82). The HU of urine samples scanned the same day as collection did not differ significantly from those stored overnight (P = 0.51).

A linear regression found that the HU of urine could statistically significantly predict urine specific gravity, F(1,38) = 95.55, P < 0.001 and that HU accounted for 72% of the explained variability of specific gravity. The regression equation was: predicted specific gravity = 1.005 + 0.0007 × (HU). Spearman’s correlation found that none of the measured urine variables were significantly associated with urine HU (P > 0.05).

The HU of urine samples in this study was highly correlated to measured specific gravity. The attenuation measurements of liquids on CT are largely due to their water content and are closely related to water concentration (2). Urine is mainly comprised of water with variable concentrations of solutes. The high proportion of water in urine explains the good correlation of urine concentration to specific gravity.

Protein causes an increase in specific gravity, and also moderately increases the attenuation of pleural fluid (exudate) as measured on CT (4). Increased HU of peritoneal fluid has also been associated with colorectal perforations, hypothesized to be secondary to increased bacteria and intestinal contents within the fluid (5). We did not find protein to be a significant variable affecting urine HU measurement in dogs. There was a wide distribution of protein levels in the samples used. However, the generally low concentrations may explain the lack of attenuation changes caused by protein in urine (0.15 to 5.0 g/L) compared to an exudate (> 29 g/L).

The effective atomic number of a substance determines the degree to which it absorbs X-rays, and therefore affects the CT HU. Urine has a higher effective atomic number than other body fluids (7.74 +/- 0.15), including blood, pus, and bile. High HU of urine up to 50.7 HU has been measured in dehydrated humans (6). The high attenuation of samples with higher specific gravity is likely due to the concentration of electrolytes in the urine. This may indicate that other solutes in urine have more effect on the measured HU than the presence of common solutes measured on urinalysis.

Computed tomography attenuation is affected by the k-edge of materials. Photoelectric absorption of X-rays increases abruptly at an energy just higher than that of the K shell electron. Sodium chloride has been shown to linearly increase the HU of solutions, in the range that includes renal tissue and urine, while urea had no effect (3). This is likely due to the low k-edge of urea compared to sodium chloride, and increased absorption of the X-rays by sodium chloride. Sodium in urine is regulated by tubular reabsorption, and concentration can be altered in metabolic or renal disease. Although this is not routinely measured on urinalysis, it is a possible factor affecting the variability of HU measurements in urine compared to specific gravity.

The urine samples were tested for the included variables before centrifugation. This may introduce a discrepancy between the urine tests and the CT attenuation of the sample. The remainder of the variables are soluble in water and centrifugation should not have a significant effect. No differences were found between the variables and urine HU, likely indicating any effect of centrifugation was small.

The effect of residual debris in the current study was evaluated by inverting the samples and re-scaning them. There was no significant difference in HU between these conditions indicating that the samples were free of suspended particles. When translating this technique to the clinical environment, consideration should be given to the presence of urine sediment in the live animal. The urine samples in this study were centrifuged to remove the suspended particles. Animals under anesthesia are likely to have settling of debris in the dependent portion of the bladder, making the center or superficial layer of urine the most appropriate for measurement. Debris could
increase the HU of urine if included in the region of interest or suspended in the urine. 

In conclusion, the measured HU of urine explained a high level of the variance in measured urine specific gravity. This noninvasive measurement can be used to estimate urine concentration in dogs undergoing abdominal CT imaging.

References
Brief Communication  Communication brève

Prevalence of Maedi-visna in Saskatchewan sheep

Rhonda Heinrichs, Wendy Wilkins, Gordon Schroeder, John Campbell

Abstract — A study was conducted to estimate flock and individual seroprevalence of Maedi-visna in Saskatchewan and evaluate risk factors for seropositive flocks. Thirty-five percent (24/68) of flocks and 4.6% (93/2010) of individual samples were positive. Within-flock prevalence ranged from 3.3% to 96.7%. Significant flock-level predictors of flock prevalence included large flock size, purchasing > 50 sheep and respiratory problems in the previous 5 years.

Résumé — Prévalence de maedi-visna chez des moutons de la Saskatchewan. Une étude a été réalisée pour estimer la séroprévalence individuelle et dans le troupeau de maedi-visna en Saskatchewan et évaluer les facteurs de risque des troupeaux séropositifs. Trente-cinq pour cent (24/68) des échantillons des troupeaux et 4,6 % (93/2010) des échantillons individuels étaient positifs. La prévalence dans le troupeau variait de 3,3 % à 96,7 %. Les prédicteurs importants au niveau du troupeau incluaient une taille importante du troupeau, l’achat de > 50 moutons et des problèmes respiratoires au cours des cinq années antérieures.

Can Vet J 2017;58:183–186

Maedi-visna (MV), also known as ovine progressive pleuropneumonia (OPP), is one of the major production-limiting diseases facing the sheep industry in Canada. The non-oncogenic, non-immunosuppressive virus belongs to the family Retroviridae and subfamily Lentivirinae. Animals usually become infected orally, through ingestion of colostrum or milk that contains virus, or via the respiratory tract from the inhalation of aerosolized virus (1). Most infections with MV virus are subclinical and clinical signs are most common in sheep over 4 y old (1). A slowly progressive disease, wasting and increasing respiratory distress are the main signs; coughing, bronchial exudate, depression, and fever usually only occur if there is secondary bacterial infection present (1). A noninflammatory, indurative mastitis is also a common clinical finding (1). Infected animals are likely to remain in a flock for some time, perpetuating the disease within the flock until they succumb to the disease or are culled.

The first Canadian cases were reported in the early 1970’s (2–4). Subsequent to that, MV has spread throughout Canada. A 1988 study in Ontario found 20.9% seroprevalence at the individual level and 69.9% at the flock-level (5). A national serosurvey for MV conducted during 1988 to 1989 found that the provinces of Quebec (39.9%) and Nova Scotia (26.5%) had significantly higher individual MV seroprevalence in sheep than the other provinces (6). In that study, 725 ewes selected from 15 Saskatchewan flocks had a seroprevalence of 3.1% and 7 of 15 flocks (46.7%) tested had at least 1 individual test positive. To the best of our knowledge, that was the only investigation of MV in Saskatchewan. The objective of this study was therefore, to investigate the current prevalence of this disease in the Saskatchewan sheep population, and to evaluate factors associated with MV-positive flocks.

The research plan called for the simple random sampling of 75 flocks across Saskatchewan, with samples to be taken from 30 individual animals within each flock. The number of flocks and individuals to be sampled was decided upon primarily due to logistical and budgetary considerations. No attempt was made to differentiate between meat or dairy production. Samples were collected by private veterinarians, and the date, time, and location of sampling were arranged by the flock owner. All veterinary and laboratory costs were paid for through the study.

The sampling frame consisted of all flocks (n = 980) registered with the Saskatchewan Sheep Development Board as of December 2013. The list of registered producers was randomized using a random number generator, and producers were contacted by telephone starting at the top of the randomized list and continuing until the target number of voluntary participants was met. Initially, only flocks with 100 animals or more were targeted for inclusion; however, in order to recruit sufficient participants, this was modified to include any flock with at least...
30 animals. A convenience sample of 30 animals (both rams and ewes) that were 2 y of age or older were chosen within each flock for testing. Blood was collected from each animal by jugular venipuncture using standard techniques.

A questionnaire was used to collect flock-level information including flock size and production characteristics, management practices, veterinary contact, and flock-level animal health syndromes observed in the last 5 y. Questionnaires were sent to each producer to be completed prior to the farm visit for blood collection or, in some cases, were completed during a follow-up phone call with the producer. Completed questionnaires were returned to the primary investigator and answers were entered into an Excel spreadsheet (Microsoft 2010; Microsoft Excel, Redmond, Washington).

Samples were submitted to Prairie Diagnostic Services (PDS) laboratory in Saskatoon, Saskatchewan. Serum antibody levels to MV were determined using a commercial enzyme-linked immunosorbent assay (ELISA) kit (CAEV cELISA; VMRD, Pullman, Washington, USA). Antibodies in the serum sample compete with a monoclonal antibody for binding to viral antigen. The result is expressed as the percentage inhibition, and values ≥35% are considered positive. This test was validated in sheep infected with North American MV strains to have a sensitivity of 98.6% and specificity of 96.9% when used with sheep sera (7); however, recent work has shown that the VMRD ELISA has one of the poorest specificity values (80.9%) among commercially available ELISAs for MV (8). Therefore, all samples that tested positive for MV were sent to the Animal Health Laboratory (AHL), Guelph, Ontario, for verification of positive results via a different commercial ELISA (Elitest MVV/CAEV ELISA; HYPHEN BioMed, Paris, France). Samples that were “high negative” (below the cutoff value of 35.0% but above 25.0% inhibition), were also sent for verification.

To model the relationship between flock level predictor variables and flock MV sero-status, logistic regression analysis was implemented in Stata/IC 12.0 (StataCorp, College Station, Texas, USA). Analysis was done twice, once with flocks designated as MV positive if 1 or more animals in the flock tested positive for MV and once with flocks designated as MV positive if 2 or more animals tested positive. Multi-variable analysis was not undertaken because of the small sample size and because this was not the primary focus of the study, which was estimating disease prevalence and describing flock-level factors associated with MV.

Flocks were visited once between May 1, 2013 and May 31, 2014. Blood samples (n = 2041) were collected from 68 flocks across Saskatchewan. Completed surveys were returned by 65 participants. The average flock size was 200 adult animals [median 125; range: 36 to 1004 ± standard deviation (SD) 203]. Six farms were purebred operations only, 39 farms raised commercial stock only, and 19 farms raised both purebred and commercial animals; 4 farms did not specify.

Twenty-four flocks had at least 1 MV-positive test result [apparent prevalence (AP): 35.3%; 95% confidence interval (CI): 25.0% to 47.2%], while 14 flocks had 2 or more positive tests (AP: 20.6%; 95% CI: 12.7% to 31.6%). There were 93 positive samples in total (AP: 4.6%; 95% CI: 3.8% to 5.6%) and within-flock positive results ranged from 3.3% to 96.7% (1/30 to 29/30). The distribution of positive titers is shown in Figure 1. One hundred and two sera were sent to AHL for verification of MV test results. Of the 93 positive samples sent, 5 (5.4%) were test-negative by the Hyphen ELISA, while 4 (44.4%) of the 9 negative samples were test-positive by the Hyphen ELISA. When the Hyphen ELISA results were taken as the true results, this changed flock status for only 1 flock (from positive to negative), and then only when a cutoffpoint of 2 positive tests was used to define a positive flock.

Flock-level predictors of MV flock prevalence, at cutpoints of 1 or 2 positive tests per flock (based on the VMRD ELISA results), are reported in Table 1. As shown, when using a cutpoint of 1, large flock size (OR = 15.4; P < 0.01), was positively and significantly associated with positive MV flock status. Purchasing > 50 sheep or reports of respiratory problems in the previous 5 y also tended to be associated with positive MV flock status (OR 2.9; P = 0.07 and OR 2.6; P = 0.08, respectively). At a cutoff point of 2, large flock size (OR 19.3; P = 0.01), purchasing > 50 sheep (OR 7.2, P < 0.01) and reports of respiratory illness in the previous 5 y (OR 3.6; P = 0.04) were all positively and significantly associated with positive flock status.

The results of this study, with 4.6% and 35.3% individual and flock seroprevalence, respectively, are similar to those of the study undertaken across Canada in the late 1980’s (6), which found that 3.2% of the Saskatchewan sheep sampled were test-positive and 46.7% of the Saskatchewan flocks sampled were test-positive when 1 positive test was used to define a positive flock. It is impossible to say whether a decline by 12% in flock prevalence is real or not, since considerable time has elapsed between studies, ELISA assays were not identical (indirect ELISA was used in the earlier study, versus competitive ELISA in the current study), and diagnostic techniques in general have evolved over time. Sampling strategies also differed, in that far fewer Saskatchewan flocks were included in the previous study and all animals in a flock were sampled (limited to 200 animals in flocks with > 200 head), versus more flocks and fewer animals per flock samples in the current study.

Figure 1. Within-flock distribution of Maedi-visna seropositive tests results in 68 sheep flocks in Saskatchewan.
In this study, larger flock size was significantly associated with MV-positive flock status, which is consistent with findings from previous studies in Canada (8), Manitoba (9), and elsewhere (10). The positive and strong association of introduction of new animals in the last 5 years with flock level MV status observed in this study underlines the importance of this factor as a means of introduction into naive flocks, and is similar to findings of the 2008 study in Manitoba (10). It is likely that owners of larger flocks are also more likely to purchase > 50 sheep in the past 5 y than are owners of smaller flocks; however, for reasons stated previously this was not evaluated in a multivariable analysis, nor was it examined in the Manitoba study.

Practices that may be indicative of better managed flocks, such as regular vaccination and regular deworming, may in theory be associated with a reduced risk of MV; however, there was no statistical association between the use of regular vaccination, regular deworming, or cross-fostering with flock status. A flock history of mammary problems, lameness/musculoskeletal problems or unthriftiness, syndromes often associated with MV disease, was also not found to be significantly associated with flock status. A flock history of respiratory disease, however, was found to be marginally associated (% 0.08) with flock status when a cutpoint of 1 was used, and significantly associated (% 0.04) when a cutpoint of 2 was used. This differs somewhat from the Manitoba study, which found that lameness/musculoskeletal syndrome was associated with flock status (% 0.04) but respiratory syndrome was not (% 0.38). The reason for the different findings is unknown, but it is clear that reliance on clinical signs alone is not sufficient to predict flock status for MV.

While more sensitive and specific ELISAs are available (11), there is a significant cost advantage to using the VMRD assay compared with some other commercially available assays. This, along with the fact that PDS offers the VMRD assay locally which simplified the submission process for veterinarians, made this test the logical choice for this project. Assuming a specificity of 96.9% (7), we can anticipate 3 false positives for every 100 truly MV-negative animals, and many more if a specificity of 80.9% is assumed. It is likely that some of the positive test results in this study were in fact false positives, and for this reason all positive samples were sent to Animal Health Laboratory in Guelph for verification with the more sensitive and more specific Hyphen ELISA for MV. Assuming the Hyphen test to be the accurate test, there were 5 false-positive and 4 false-negative results among samples subjected to both tests. Still, this information did not change the status of any flock, as determined by the VMRD ELISA, when a cutpoint of 1 positive test was used. When a cutpoint of 2 positive tests was used, the Hyphen test results caused a change in MV-status for just 1 flock, from positive to negative.

Test results for MV must always be interpreted with caution. One positive test in a flock of 100, for example, does not necessarily mean that MV truly exists in that animal or within the flock. The more positive tests there are, the more certain a producer can be that MV is present. Certainly, the producer with 29/30 positive tests can be very certain that MV is a serious problem in his or her flock. Because of the probability of false positive tests, we would recommend that at least 2 positive results be required to consider a flock MV-positive. Conversely, we cannot be absolutely certain either that MV is not present when all tests are negative, as false negative results can also be expected. Repeat testing is recommended as a means to ensure the continuing absence of MV from a flock.

Finally, 2/3 of flocks tested had no evidence of MV infection, indicating that the majority of Saskatchewan flocks are MV-free. To help keep the disease out of their flock, owners are encouraged to only purchase replacement stock of known MV-status and to isolate their sheep from other potentially infected sheep or goats. Operators of known infected flocks could consider eliminating the disease via ongoing test-and-cull, feeding colostrum/milk replacement products or heat-treated colostrum and pasteurized milk to replacement ewes, and following good biosecurity practices such as single-use needles and sterilizing other treatment equipment before use on other animals.

Acknowledgments
We thank Dr. Paula Menzies, University of Guelph, for her advice and insight into tests for MV and information on the
diagnostic accuracy of ELISAs for MV and Dr. Glen Duizer, Manitoba Agriculture, Food and Rural Development, for sharing the producer survey used in the MV study in that province. We offer heartfelt thanks to producers who helped in the successful completion of this study.

References
An unusual case of peripheral vestibular disease in a cat following ear cleaning

Sangsoo Daniel Kim

Abstract — The occurrence of vestibular disease in a cat following a wellness/vaccination visit which included routine ear cleaning is described. The cat recovered in 10 days following supportive therapy. The cause of vestibular disease was not identified but sensitivity to an ear cleaning solution or subclinical ear disease may have played a role.

Discussion

The vestibular signs presented in this case are a typical presentation of bilateral peripheral vestibular disease (1). Peripheral vestibular disease is associated with numerous disorders, but otitis media and/or otitis interna and idiopathic disease are the 2 major causes (1). The present case was unusual given that the patient had been healthy and the otoscopic examination and bulla radiography showed no abnormalities. Vaccine-associated adverse events have been well-documented in the literature, but vestibular signs secondary to vaccination have not been reported (2–5). Given the large number of animals studied for vaccine-associated adverse events, it is unlikely that vestibular signs are due to vaccine reaction (4,6).
Table 1. Compiled and categorized database gathered from case discussions from the Veterinary Information Network

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-category</th>
</tr>
</thead>
<tbody>
<tr>
<td>General information</td>
<td>Date posted, species, gender, age, reason for visit</td>
</tr>
<tr>
<td>Procedures performed</td>
<td>Ear flush, gentle ear cleaning, vaccination, dental, anesthesia, or sedation</td>
</tr>
<tr>
<td>Physical status of ear</td>
<td>Tympanic membranes before and after procedure</td>
</tr>
<tr>
<td>Concurrent ear problem</td>
<td>Otitis externa, otitis interna/media, or healthy ear</td>
</tr>
<tr>
<td>Time of onset</td>
<td>Immediately after procedure, same day, next day, more than 1 day</td>
</tr>
<tr>
<td>Specific clinical signs</td>
<td>Deafness, anorexia, decreased drinking, ataxia, falling to the side, nystagmus, head tilt, side-to-side head excursion, circling, wide stance, anisocoria, ptosis, protruded nictitans, enophthalmos, unspecified vestibular signs, unspecified Horner's syndrome</td>
</tr>
<tr>
<td>Recovery</td>
<td>Time took to recover if reported based on specific clinical signs</td>
</tr>
<tr>
<td>Ear cleaning solution and topical medication used</td>
<td>No sub-category</td>
</tr>
</tbody>
</table>

Idiopathic peripheral vestibular disease, sometimes referred to as geriatric vestibular disease in small animals, can occur in cats of any age (1,7). The incidence is reported to be higher in outdoor cats in July and August in northeastern and mid-Atlantic regions of the United States (7,8). Treatment is often supportive and symptomatic therapy usually results in improvement within 3 to 5 days with resolution of nystagmus and with the remaining clinical signs resolving over 3 to 4 weeks with occasional residual head tilt (1,9).

The cause of vestibular signs in this patient is unknown, but it is presumed to be associated with the ear cleaning which preceeded the vestibular signs. Known ototoxic compounds include oral and/or topical medications including antibiotics (aminoglycosides), diuretics (furosemide), anti-neoplastic agent (cisplatin), salicylates, and detergents such as chlorhexidine (10–13). The ear cleaning solution used for this patient (water, cocomidopropyl betaine, PEG-60 almond glycerides, mackalene 426) does not contain any substances reported to be ototoxic, but the patient may have been sensitive to 1 or more of these compounds.

Cats may have sensitive ears that may predispose them to be more susceptible to ototoxic substances. The cat’s ventral bulla is divided into 2 compartments by an incomplete septum, and the branch of the sympathetic nerve that runs through the septum is susceptible to injury during ear cleaning (14,15). The lack of elastin fiber in tympanic membranes may also play a role in the susceptibility to injury of cats ears during cleaning procedures (16). Cats can have otitis media without overt otitis externa (11). A recent study showed that middle ear disease is more common than the literature suggests, and more importantly, in a significant number of cases histologic evidence of otitis media was present in ears that were grossly normal (17).

Table 2. A summary of anecdotal evidence of acute onset of vestibular signs after ear cleaning procedures compiled from a Veterinary Information Network search

<table>
<thead>
<tr>
<th>Number of cats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total case number</td>
</tr>
<tr>
<td>Mean age (median)</td>
</tr>
<tr>
<td>Reported specific vestibular signs</td>
</tr>
<tr>
<td>Anorexia</td>
</tr>
<tr>
<td>Decreased water intake</td>
</tr>
<tr>
<td>Ataxia</td>
</tr>
<tr>
<td>Falling to the side</td>
</tr>
<tr>
<td>Nystagmus</td>
</tr>
<tr>
<td>Head tilt</td>
</tr>
<tr>
<td>Side-to-side head excursion</td>
</tr>
<tr>
<td>Circling</td>
</tr>
<tr>
<td>Wide stance</td>
</tr>
<tr>
<td>Anisocoria</td>
</tr>
<tr>
<td>Ptosis</td>
</tr>
<tr>
<td>Elevated nictitans</td>
</tr>
<tr>
<td>Enophthalmos</td>
</tr>
<tr>
<td>Deafness</td>
</tr>
<tr>
<td>Onset of the clinical signs since the procedures</td>
</tr>
<tr>
<td>Immediately</td>
</tr>
<tr>
<td>Less than 24 h</td>
</tr>
<tr>
<td>Greater than 24 h</td>
</tr>
<tr>
<td>Time taken for improvement or resolution of the vestibular signs among specified casesa</td>
</tr>
<tr>
<td>1 week</td>
</tr>
<tr>
<td>4 weeks</td>
</tr>
<tr>
<td>Ataxia</td>
</tr>
<tr>
<td>Nystagmus</td>
</tr>
<tr>
<td>(unspecified) Vestibular signsb</td>
</tr>
<tr>
<td>(unspecified) Horner's syndromec</td>
</tr>
<tr>
<td>a Not all discussions had a follow-up on the patient’s recovery.</td>
</tr>
<tr>
<td>b Number of case discussions that reported improved vestibular signs or Horner’s syndrome without mentioning the specific clinical signs.</td>
</tr>
</tbody>
</table>

Although otitis in small animals is relatively common, it appears that ototoxicity has received little attention in the veterinary literature, particularly in the context of ear cleaning. No literature was found that documented the specific vestibular signs or the prognosis in cases other than those involving known ototoxic agents in patients with ruptured tympanic membranes or concurrent ear disease. However, there are numerous anecdotal reports on the Veterinary Information Network (VIN) indicating a possible direct association between peripheral vestibular syndrome and routine ear cleaning. A search of the VIN website (http://www.vin.com) with keywords "vestibular and ear cleaning" sorted by relevance, identified discussions that involve sudden onset of vestibular syndrome following ear cleaning in cats and dogs.

A total of 101 cases from the search were reviewed to evaluate a possible association between peripheral vestibular syndrome and routine ear cleaning. Out of 101 case discussions, 25 cases involved cats with no evidence of otitis externa and intact tympanic membranes bilaterally in otoscopic examination. The information collected is summarized in Tables 1 and 2.

In this case, due to financial constraints, additional diagnostics were not performed for a definitive diagnosis of feline idiopathic vestibular disease. Despite the present case work-up, the age of patient, and recent literature findings suggest that the patient may have had subclinical ear disease not noted on
examination; this could have been exacerbated by the ear cleaning procedures (11,17). Ear cleaning is often a part of a veterinarian’s routine wellness appointment. The observations made herein suggest that vestibular disease can be a consequence of routine ear cleaning procedures. Extra caution is recommended in patients with concurrent otitis externa, and the risk of this procedure should be fully communicated to clients. Further prospective studies could help determine the prevalence of complications and risk factors associated with ear cleaning in cats and dogs.

Acknowledgments
I offer sincere thanks to Dr. Frits Verzijlernberg for his support and mentorship with this case, and the staff at Verzijlernberg Veterinary Hospital for a warm environment and wonderful experience throughout the externship program. Also, I thank Drs. Shauna Blois and Fiona James for their kind support, thoughtful comments, and advice.

References
Combine uncompromised dental health with nutrition that promotes everyday vitality.

NOW THAT'S HOW DENTAL IS DONE

PRESCRIPTION DIET® t/d®
#1 VET-RECOMMENDED DENTAL PET FOOD for complete care

SUPERIOR CLINICAL EFFICACY in reducing plaque, tartar and the occurrence of gingivitis

A vital part of a pet’s DAILY HEALTH regimen — helps maintain healthy digestion, keep pets fit and trim with a luxurious coat

URINARY SAFE — helps reduce the risk of struvite and calcium oxalate stone formation
What Can’t Be Taught
Ce qui ne s’enseigne pas

The path to success

Dr. Heather Gunn-McQuillan

Reflecting back on my first year in practice, I can’t help but think that it’s funny where your path ends up taking you. That’s part of the beauty of the future. It is unknown and ripe with potential. For the last 3 years I have given a lecture to a group of first year veterinary students about unconventional careers in veterinary medicine. To date, my career path has been just that, interesting, unconventional, and not what I would have ever predicted when I first stepped out into practice. During that lecture I put up the same slide every year about the path to success. You may have seen it. It shows two arrows side by side. The one is straight, pointing upwards, and is labelled, “Success: What people think it looks like.” The other is a convoluted line of twists and turns, ups and downs, circles and knots, and is labelled, “Success: What it really looks like.” Even though the arrows eventually end up in the same “successful” place, the slide illustrates the point that there is rarely a straight line to your end goal.

“Who here is planning to own their own practice?” the professor at the front of the room asked. I still remember that day in vet school like it was yesterday, even though it was nearly 15 years ago. I was sitting in an Art of Veterinary Medicine class at the Ontario Veterinary College and we were talking about business ownership. About 20 of us, a fifth of the class and myself included, raised our hands. I thought I had my path all mapped out. I would graduate from vet school, go work for a year or two in mixed practice, and then buy my own shop. I had always wanted to own my own business, and had always had an entrepreneurial spirit, running several small ventures when I was younger. To me, the path to success in veterinary medicine was the ability to have your own piece of the pie, where you got to run things the way you wanted to, and to grow a business with your own vision. There was excitement in steering a ship, mentoring lots of people, and leading people towards a common goal. As the daughter of an engineer, I loved the idea of building something up, making it better. Yet if someone would have told me then the twists and turns my path would take, I never would have believed them.

True to my initial vision, I headed to a mixed animal practice in a rural community upon graduation. I was a food animal person, passionate about swine medicine, but I also enjoyed small animals too, and often joked that my future clinic would be called “Hogs and Dogs Veterinary Hospital.” That first year out was an eye opener and it all but washed my dream away. Swine prices had bottomed out, and I had graduated in the face of the BSE crisis. Food animal work was nearly non-existent, and what little there was amounted to “blessing cows” instead of getting to do anything interesting or progressive. The nice thing about mixed practice is it has a little bit of everything in it, and I got to experience things that I never thought I would enjoy. Who knew I’d enjoy working with horses? The thought of touching these million dollar racetrack animals in vet school had made me nauseous, but far from the track, the horses and horse owners in Northern Ontario were fabulous. Small animal practice also became something I grew to love even more. A consummate problem solver and a lover of hands-on learning, the challenges of unravelling a complex medicine case was thrilling. Being isolated from specialty referral practices meant that this little vet clinic tackled some pretty cool surgeries that I would later learn were rarely performed outside of a specialist’s hands. I learned to be brave and stand on my own two feet. But the hours were brutal, the on-call nearly killed me, and I seriously questioned my decision to become a veterinarian on more than one occasion.

Veterinary technicians will be your best friend when you graduate from vet school. They will be your safety net, a listening ear, your biggest help, and your greatest champion. It wasn’t until a special vet tech said to me, “Heather, if you stay here, this is as good as you will ever be, and you’ve got so much potential,” that I realized I needed to move on. And so the first twist in my path started, with many, many more to follow. In the years since that first job, I’ve worked in AAHA accredited small animal practices with all the bells and whistles, I opened my own locum business, I worked in academia, private industry, and eventually found my arrowhead.

I never opened my own shop, and I’m fairly certain that I never will, but I never lost that passion for business and leadership. As the Director of the Veterinary Teaching Hospital at the Atlantic Veterinary College, I get to fulfill all the criteria that I defined as being successful when I was a student and I get to follow that passion. I lead a phenomenal group of people and we
work together towards a common vision, excellence in veterinary service and teaching. In terms of building and making things better, my entire team gets to work towards improving the most important thing in veterinary medicine, future veterinarians. I love the feeling of having exponential impact on the next generation of veterinarians, and I couldn’t be more proud of what I am doing today. I often tell the students that everyone has an idea of their path, but it’s okay for that vision to change, because it often will. If you keep an open mind, follow your passion, and do what makes you happy, the possibilities in veterinary medicine are endless.

### Answers to Quiz Corner

**1. C)** Ivermectin is a semisynthetic analogue of avermectin. Collies and other herding breeds commonly carry a genetic defect of the multi-drug resistant gene (MDR-1 deletion mutation). This genetic defect produces a nonfunctional P-glycoprotein, enabling ivermectin to attain higher concentrations in the CNS, resulting in toxicity at lower doses.

**C)** L’ivermectine est un analogue semi-synthétique de l’avermectine. Le Colley et les autres races de chiens de troupeau portent communément un défaut génétique du gène de multirésistance aux médicaments (gène MDR-1). Ce défaut génétique produit une glycoprotéine P non fonctionnelle, permettant à l’ivermectine d’atteindre des concentrations plus élevées dans le système nerveux central, ce qui produit une toxicité à faibles doses.

**2. D)** Aspiration of a clear fluid indicates a spinal, not epidural placement of the needle. There should be no resistance to a test injection of saline. The “hanging drop” disappearing into the needle is a positive sign of correct placement. No crepitus should be felt after a test injection of air through the epidural needle.

**D)** L’aspiration d’un liquide clair indique une position spinale et non épidurale de l’aiguille. Il ne devrait pas y avoir de résistance à une injection d’essai de saline. La «goutte suspendue» disparaissant dans l’aiguille est un signe positif de la bonne position de l’aiguille. Aucune crépitation ne devrait être perçue après une injection d’air par une aiguille épidurale.

**3. B)** FeLV often results in a carrier state. It does not survive in the environment for long periods, and it is killed by disinfectants. Transplacental transmission can occur. A nonregenerative anemia is common.

**B)** Le VLFe résulte souvent en un état de porteur. Il ne survit pas dans l’environnement durant de longues périodes et il est inactivé par les désinfectants. La transmission transplacentaire est possible. Une anémie non régénérative est commune.

**4. C)** Bruxism

**C)** Bruxisme

**5. D)** Ingestion of a sufficient quantity of clean, good-quality colostrum, within the first 12 hours of life, is important. This can be guaranteed if the calf is removed from the cow soon after parturition, and fed from a bottle. Intubation is recommended if suckling is incomplete. Ear tags should be applied to calves immediately after parturition to prevent mistakes in parentage being recorded after separation from dams. Cows and heifers should be made to rise soon after parturition so that hind limb paresis can be identified [usually associated with maternal obstetrical paresis or paralysis in heifers, and with milk fever (hypocalcemia) in cows] and cows can be encouraged to lick their calves dry.

**D)** L’ingestion de colostrum clair de bonne qualité dans les premières heures de la vie est importante. Ceci doit être réalisé si le veau est retiré de la vache peu de temps après la parturition et qu’il est nourri à la bouteille. L’intubation est recommandée si l’allaitement est incomplet. Les étiquettes d’oreilles doivent être appliquées aux veaux immédiatement après la parturition pour prévenir des erreurs d’ascendance après la séparation de la mère. Les vaches et les génisses doivent se lever le plus tôt possible après le vêlage pour permettre d’identifier une parésie possible des membres postérieurs [habituellement associée à une parésie obstétricale maternelle ou à une paralysie chez les génisses et à une fièvre du lait (hypocalcémie) chez les vaches]; on devrait encourager les vaches à lécher leurs veaux afin de les sécher.
The Art of Private Veterinary Practice
L’art de la pratique vétérinaire privée

Retro communication

Myrna Milani, DVM

As the companion animal portion of his practice grew, Dr. Emory began looking for an associate to take over that segment of the workload. Although he enjoyed the company of his own companion animals, his professional heart and mind belonged to his food animal clients and their herds and flocks.

Of all the applications he received, Dr. Kemon’s impressed him the most. She had 10 years of experience in companion animal practice, excellent references, and a desire to move to the area to be closer to her family. However, because her family did live in the area and Dr. Kemon was the same age as one of his daughters, Dr. Emory remembered her as she was back then. “Back then” was when she was her late teens and deeply involved in what he recalled as “radical veganism.” Consequently, his initial response when he received her application was to write her that he had filled the position. However, he did not because, aside from the fact that this was not true, she was the most qualified applicant for the job. At least on paper. Because of this, he decided to interview her.

Like most, if not all, practice owners considering hiring an associate, quality communication ranks high on Dr. Emory’s list of must-haves for all members of his staff. He knows from experience that saying the wrong thing at the wrong time easily could alienate clients faster than making a diagnostic or treatment error. And because many of the clients whose companion animals his new associate would be seeing belonged to ranchers and farmers with whom he had worked hard to develop solid professional relationships, he needs to be sure Dr. Kemon would not alienate those people.

Fortunately, Dr. Emory also concedes that his previous knowledge of Dr. Kemon paradoxically works for and against him. He knew her as a child and young adult who participated in many of the same school and community activities as his daughters did. They all shared an interest in animals and were good at handling them. When they became teenagers, all of them adopted causes about which they felt passionately. About the time his eldest daughter decided to take on the oil sands industry, Katie Kemon decided to become a vegan and began wearing t-shirts with inflammatory slogans such as, “Eating meat is murder.” Back then, Dr. Emory thought Katie Kemon’s parents got the better deal.

“True, but I wasn’t considering hiring her then,” he tells his office manager.

Then Dr. Emory reminds himself that people change, and especially younger ones. Now he feels nothing but pride for his conservation ecologist daughter and her accomplishments. For all he knew, Dr. Kemon could have tempered some of her more extreme views or even abandoned them completely.

Meanwhile Dr. Kemon attempts to process her own mixed feelings about her impending interview with Dr. Emory.

“What about your animal rights-related activities? Won’t those create problems with a lot of people in that area?” asks her friend.

Dr. Milani is a behavior and bond practitioner, teacher, and author of several books on the interaction of animal behavior, health, and the human-animal relationship.

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.
All impending job interviews provide applicants as well as practice owners with an opportunity to review if and how their animal and veterinary practice philosophies have evolved over time. It also enables them to compare and contrast these to those maintained by the client base and practice area. While always true, this is particularly true when job applicants seek to return to areas where they lived or worked years previously. When such is the case, a certain amount of type-casting may have occurred. If so, this increases the potential for employer-employee and new associate-client communication problems.

For example, suppose Dr. Emory assumes that Dr. Kemon is the same person she was in her late teens and opens the interview by declaring, albeit politely, that he will not tolerate any lecturing of his clients regarding their animals’ rights and welfare.

“While I respect your right to believe whatever you want,” he tells her in this scenario, “I can't have you lecturing my clients about what they can and can't do with their animals. And no inflammatory t-shirts or bumper stickers, either.”

Such a paternalistic approach is not a good way to ensure quality communication regarding potentially problematic areas of employer-employee conflict. At best, these may cause Dr. Kemon to say nothing. At worse, Dr. Emory’s comments may trigger an equally inappropriate defensive response.

On the other hand, if Drs. Emory and Kemon treat each other as professional colleagues from the beginning, there is no reason for Dr. Emory to feel uncomfortable asking Dr. Kemon about her animal-rights views. Nor is there any reason for Dr. Kemon to take such questions personally. Keeping the discussion on a professional level enables both veterinarians to voice any potential costs of Dr. Kemon’s views to the practice as well as any benefits. This also provides Dr. Emory with an opportunity to describe the animal rights and welfare situation in the area now and the goals he and others are working toward. As she responds to his comments, Dr. Kemon demonstrates how her own views have matured since she left the area.

In this situation, the veterinarians discover that over the years their once opposite views had evolved. Even better relative to their ability to work together successfully for their mutual benefit and that of the practice, their views now complement each other.

But although this resolves what the two veterinarians considered the major obstacle they needed to resolve in order to work well together, Dr. Kemon still faces some communication challenges. Dr. Emory is not the only person who may have memories of her as she was when she left the area instead of as the young professional practitioner she had become. If there was anything about her animal-related beliefs that they still found troubling, these will need to be addressed before clients will feel comfortable bringing their companion animals to her for care.

In this regard, Dr. Emory can be a tremendous help paving the way for his new associate with his clientele because he already has a professional rapport with these people and they respect his opinion. In addition to announcing Dr. Kemon’s arrival on his website and in his monthly newsletter, he also brings it up in informal conversations with his clients when he makes his rounds.

“I suppose you’ve heard through the grapevine that I’ve hired Katie Kemon to take over the companion animal part of my practice,” he casually mentions as he and his client’s assorted pack of dogs and cats head for the barn. “She always was smart as a whip as a kid, and she’s grown up to be a crackerjack companion animal vet as well as a fine young woman.”

In such a way he gives his new associate his public stamp of approval as well as noting she is no longer the youngster they may remember. If they bring up her inflammatory animal rights rhetoric, he counters with good-natured reminders that education and experience broaden the views of most younger folks. If necessary, he also can summon examples of how he and most of his clients at one time or another had taken a strong stance on some animal-related subject, only to moderate or change their views completely as they became more informed.

Multiple philosophers have pondered the challenges associated with going home again. And to a one they conclude this is impossible because everything and everyone constantly changes, albeit some more so than others. But at the same time, returning to one’s home area to practice offers benefits too. The challenge is to ensure a smooth transition from past to present.
Oral Surgery: Treatment of a dentigerous cyst in a dog

Dr. Graham Thatcher

Dentigerous cysts are rare epithelium-lined structures that develop in tooth-bearing jaws of domestic animals (1,2). Dentigerous cysts are considered to be the most common of these cysts, with periapical cysts and odontogenic keratocysts occurring less often (3). Dentigerous cysts are dilations of the follicular space around the crown of an unerupted or impacted tooth that arise from the epithelial remnants of the enamel organ or the reduced enamel epithelium that surrounds the crown during odontogenesis (1,4). Dentigerous cysts can present as a large swelling in the jaw or simply as a missing tooth but are often incidental findings during intra-oral radiographs, as they are considered to be painless unless infected, and thus can go unnoticed. Radiographs should be performed whenever a tooth is missing from the dental arches as these cysts can expand to large sizes, ultimately affecting surrounding teeth and can lead to pathologic fractures. This report examines the diagnosis and management of a dentigerous cyst in a Boston terrier.

History

A 9-year-old, 10-kg, female, spayed Boston terrier was referred for evaluation of mobile mandibular incisors. The patient had been evaluated by several veterinarians in the previous years and medical records from 2 veterinary clinics included “missing teeth” in the medical records; however, no recommendation of further investigation was noted. The owner of the dog had requested that the veterinary ophthalmologist extract the mobile teeth while under general anesthesia for ocular surgery. The patient was referred for dental care by the ophthalmologist; according to the owner, no professional dental care had previously been performed or recommended.

Diagnostics

Upon physical examination, the patient was noted to have a healthy body condition and was bright, alert, and responsive. Thoracic auscultation was unremarkable with normal lung sounds and a normal heart rhythm with no detectable heart murmur. The pre-anesthesia laboratory tests included a complete blood cell count and blood chemistry. The results of the pre-anesthetic tests were all within normal reference ranges. Upon conscious oral examination, several teeth were missing, including 304, 305, 311, 404, and 411. The mandibular incisors and the right mandibular first and second premolars were mobile (Figure 1). There was a supernumerary right maxillary second incisor and a Class III malocclusion (mandibular prognathism) with contact of the maxillary incisors with the floor of the mouth, lingual to the mandibular incisors. The maxillary second and third premolars on both sides were rotated approximately 45 degrees mesiopalatally.

Diagnosis

While under general anesthesia, intra-oral radiographs were taken and revealed the impacted mandibular canine teeth with a large unilocular radiolucency associated with the right mandibular canine tooth (404) affecting the crown of the tooth, while sparing the root of the tooth. The radiolucency appeared as loss of alveolar bone support of the roots of the lower right first 3 premolars and the right mandibular third incisor (403, 405, 406, and 407) (Figure 2). The gingiva dorsal to this radiolucency was soft and fluctuant with a bluish color (Figure 3). There was Stage 4 periodontal disease noted on all of the mandibular incisor teeth; however, no other periodontal pockets were noted during the oral examination. This periodontitis was likely the result of the traumatic contact of the maxillary incisors on the floor of the mouth, lingual to the mandibular incisors, other than the mandibular right third incisor, which was affected by the expanding cyst (Figure 4). The lower left canine tooth (304) was impacted with radiographic evidence of endodontic disease presenting as a smaller radiolucent area surrounding the root apex (Figure 5). The missing 305, 311, and 411 were confirmed by radiography to be absent. Differential diagnoses for the large radiolucency included a dentigerous cyst, a radicular cyst, an odontogenic keratocyst, and/or odontogenic and non-odontogenic tumors.
Treatment plan

The treatment plan included a dental prophylaxis, surgical extraction of all teeth affected by the cyst (403, 404, 405, 406, and 407), complete enucleation of the cyst wall, curettage, and osteoplasty (2). The cyst lining was submitted for histopathologic evaluation which confirmed the diagnosis of dentigerous cysts and ruled out neoplastic transformation. The treatment plan also included surgical extraction of the lower incisors, and the lower left canine tooth (304) because these teeth were diagnosed with severe periodontitis (incisors) and tooth impaction (304) during the diagnostic evaluation.

Treatment

The patient was fasted for 12 h prior to admitting to the hospital for dental prophylaxis, intraoral radiographs, and oral surgery. A 20-gauge, 1.5-inch, BD-Insyte intravenous catheter (BD Medical, Sandy, Utah, USA) was placed in the right cephalic vein. A balanced electrolyte solution (Plasma-Lyte 148 Injection; Baxter, Mississauga, Ontario) was delivered at a rate of 10 mL/kg body weight (BW) per hour. Pre-anesthetic sedation was achieved with hydromorphone hydrochloride (Sandoz Canada, Boucherville, Quebec), 0.05 mg/kg BW, IV, and dexmedetomidine hydrochloride (Dexdomitor; Zoetis, Kirkland, Quebec), 3 μg/kg BW, IV. Anesthesia was induced with alfaxalone (Alfaxan; Abbott Laboratories, Saint-Laurent, Quebec), 2 mg/kg BW, IV with the full dose calculated based on the dog’s weight of 10 kg, and given to effect until the pre-oxygenated patient could be intubated without notable laryngeal reflexes. A 6.5-mm cuffed endotracheal tube (Teleflex Medical, Markham, Ontario) was placed in the trachea; the patient was connected to a Bain Circuit (Hudson RCI Bain-Circuit, Teleflex Medical) and a leak test was performed to ensure that the endotracheal tube was leak-free at 15 cmH₂O. The patient was then connected to a closed anesthetic delivery system (Aerane Anesthetic Machine; Dispomed, Joliette, Quebec), which delivered a mixture of 100% oxygen and isofluorane at a rate of 8 breaths/min with a mechanical ventilator. Throughout the procedure the patient was lying on a circulating hot water bed to ensure a normal body temperature was maintained and was monitored by a registered veterinary technician. A multiparameter monitor (Cardell Multiparameter Monitoring System;
Midmark, Dayton, Ohio, USA) was used to measure blood pressure, heart rate, respiratory rate, and end-tidal CO₂, which were recorded every 5 min throughout the procedure. An additional blood pressure monitor (Doppler BP; Parks Medical Electronic; Aloha, Oregon, USA) was used for confirmation.

The mouth was thoroughly rinsed with a 0.12% chlorhexidine solution (Nolvadent; Ayerst Fort Dodge, Colorado, USA). A complete oral examination was performed including the use of a periodontal probe (Hu Friedy, Chicago, Illinois, USA) to measure the depth of the gingival sulcus and periodontal pockets around each tooth; findings were recorded in the patient’s dental chart. Full mouth intraoral radiographs were taken with a Size 2 digital imaging sensor (Progeny Digital System; Midmark). One dose of ampicillin (Highdent Quattro; Dispomed), 22 mg/kg BW, IV, was given prior to dental prophylaxis. Complete supragingival and subgingival scaling was performed to remove plaque and calculus in order to provide a clean environment prior to oral surgery. The teeth were polished with flour pumice (Pumice polishing paste; Henry Schein, Niagara-On-The-lake, Ontario) using a snap-on rubber polishing cup on a low-speed handpiece.

Local nerve blocks were given before beginning the surgery. Bilateral middle mental and mandibular blocks were performed by placing 0.1 mL of 0.5% bupivacaine (Marcaine 0.5%; Hospira, Saint-Laurent, Quebec) at each of these sites followed by digital pressure to assist in diffusion of the block and to prevent bleeding. A large mucoperiosteal flap was created by making a sulcular gingival incision on the right mandible from the mesiolabial line angle of the first incisor to the distobuccal line angle of the fourth premolar using a radiosurgical instrument (Ellman Surgitron; Ellman International, Oceanside, New York, USA) with a vari-tip and a filtered current on power 3. A vertical releasing incision was made at the distolabial line angle of the right third incisor tooth, about 1.5 cm mesial to the right labial frenulum. A periosteal elevator (Cislak Manufacturing, Niles, Illinois, USA) was used to elevate the envelope flap with care to preserve the middle and caudal mental neurovascular...
pedicles. As the flap was elevated, the large cyst associated with the impacted right mandibular canine tooth was exposed (Figure 6). Inside and outside curved luxating elevators (Cislak Manufacturing) were carefully used to follow the path of the impacted tooth root, disrupt alveolar attachment and achieve movement within the alveolus. When enough movement was achieved, the crown of the tooth was grasped with extraction forceps and the tooth was very gently rotated back and forth in the long axis of the tooth root while simultaneously pulling on the tooth to encourage removal. Using a spoon curette, the cyst lining was carefully removed and placed in a 10% buffered formalin solution for evaluation by a pathologist. Thorough curettage was achieved in the alveolus with the same curette as well as a small bone rasp in order to prevent recurrence of the cyst, since the complete cyst lining was not removed in one piece. The wound was flushed with copious amounts of sterile saline solution followed by mobilization of the mucoperiosteal flap by incising the periosteal attachment along the ventral margin of the flap with a #15c scalpel blade. Prior to wound closure, all 6 mandibular incisors and the first 3 premolars (405, 406, 407) were surgically extracted and the alveolar bone was made smooth with the same small bone rasp. Surgical rongeurs were used to perform an ostectomy on the thin shelf of bone on the buccal aspect, which was a result of the expanding dentigerous cyst. The flap was closed with 4-0 monofilament suture material (Monocryl 4-0; Ethicon, Guaynabo, Puerto Rico, USA) in a simple interrupted pattern with the suture line over the healthy bone on the lingual aspect of the mandible (Figure 7). A decision to allow a healthy blood clot to act as the scaffold for bone growth was made, since there was ample healthy remaining alveolar bone after extraction of the impacted tooth and enucleation of the cyst. A similar approach was used to remove the incisors, impacted canine tooth, and the second premolar on the left side. Following oral surgery, intra-oral radiographs were taken to ensure that all of the planned extractions were complete (Figures 8, 9).

**Post-operative care**

Hydromorphone, 0.05 mg/kg BW, IV and meloxicam (Metacam; Boehringer Ingelheim, Burlington, Ontario), 0.15 mg/kg BW, SC, were given after surgery. The patient was given buprenorphine (Chiron Compounding Pharmacy, Guelph, Ontario), 0.015 mg/kg BW, IV, q6h following surgery until discharge the following morning. Additionally, several topical ophthalmic medications were administered while in hospital according to the instructions of a board-certified ophthalmologist in order to manage the ocular disease.

The patient was sent home 24 h after surgery with instructions to remove all chew toys and to soften the diet for 2 wk. Oral meloxicam was to be continued at a dose of 0.1 mg/kg BW, q24h, for 5 d. Oral broad-spectrum antibiotics, 125 mg amoxicillin and clavulanate potassium tablets (Clavamox; Pfizer, Kirkland, Quebec), were to be given orally, q12h for 7 d. Additionally, tramadol (Petscriptions Compounding Pharmacy, Aurora, Ontario), 5 mg/kg BW, PO, q8h, was to be given for 4 d for added pain control.

**Follow-up**

Follow-up evaluation 2 wk after surgery showed that the surgical wounds were healing well and there were no signs of dehiscence. The patient was eating well and the owner communicated that she was bright and energetic at home. The results of the histopathology were reported to the owner, which confirmed that this was a dentigerous cyst with no signs of neoplastic transformation. A plan was made to re-evaluate the bone healing with intra-oral radiographs 1 y after treatment.

The patient returned for dental prophylaxis and intra-oral radiographs at 1 and 2 y post-dentigerous cyst enucleation. Intra-oral radiographs revealed healthy mandibular bone with complete re-ossification of the cystic cavity and no signs of cystic re-formation (Figure 10).

**Discussion**

An odontogenic cyst is one in which the lining of the lumen of the cyst is derived from epithelium involved in tooth development (1,5). In dogs, odontogenic cysts include radicular cysts, odontogenic keratocysts, unclassified odontogenic cysts and...
dentigerous cysts (2,3,6–8). Histopathology is the main modality for differentiating between the various odontogenic cysts, although it is important to understand the clinical behaviors and radiographic presentations as well (2,5,6). One study (3) evaluating odontogenic cysts in dogs reports that they were incidental findings in 18 of 41 dogs (44%); they therefore often go unnoticed by pet owners. This also highlights the importance of regular, thorough oral examination, including intra-oral full mouth radiography, in dogs undergoing dental treatment (7).

Medical records for the patient herein include missing mandibular canine teeth, with the absence of dental radiographic confirmation before being referred for dental care. The study by Verstraete et al (3) also noted that of 41 dogs with cysts, 24 were brachycephalic breeds and the higher incidence of odontogenic cysts in these breeds is thought to be related to dental crowding, although the exact mechanism is unclear.

A dentigerous cyst surrounds the crown of an impacted tooth, which is caused by fluid accumulation between the reduced enamel epithelium and the enamel surface resulting in a cyst which encapsulates the crown of the tooth, but does not involve the root (1.5). Among the 41 dogs with odontogenic cysts studied by Verstraete et al (3), 29 were dentigerous cysts, with the most common site being the mandible. Histologically, the cyst lining is attached at the cementoenamel junction and has been reported to be 4 to 6 cell layers of non-keratinized stratified squamous epithelium (5,6). Although the mechanism for dentigerous cyst formation is not clearly understood, cystic expansion is thought to occur by passive osmotic fluid accumulation, proliferation of epithelial cells, and release of mediators of osteoclastic bone resorption (2,5). By definition, dentigerous cysts are associated with unerupted teeth (6), which are usually a developmental problem due to lack of eruptive forces (embedded tooth) or due to a physical barrier (impacted tooth) (9). This is conceivable with dental crowding, such as that seen in the brachycephalic dog described here. One report describes a previous iatrogenic trauma during extraction of a deciduous tooth as the cause for a dentigerous cyst (8). The age of diagnosis of dentigerous cysts ranges from 6 mo to 10 y, but most are discovered between 2 to 3 y of age (2,3). Dentigerous cysts have been reported to be associated with maxillary and mandibular canine teeth; however, they are most commonly seen with the mandibular first premolars (2,3,9).

Clinically, patients with dentigerous cysts are generally asymptomatic unless the cyst becomes infected or pathologic fracture occurs due to extensive osteolysis (3). As seen in this case, a blue to purple appearance can be seen in the mucosa overlying an expanding dentigerous cyst (3,9). Radiographic appearance of dentigerous cysts is considered to be nearly pathognomonic (9,10). The cyst appears as a radiolucent halo surrounding the crown of the unerupted tooth, with a well-circumscribed margin of thin cortical bone present (3,8–11). Adjacent tooth displacement and severe tooth resorption have been reported as sequelae to dentigerous cysts (3,10,11). Neoplastic transformation of dentigerous cysts to form ameloblastoma, mucoepidermoid carcinoma, and squamous cell carcinoma have been reported in the human literature; however, this appears to be very uncommon (5). An ameloblastic fibro-odontoma has been reported to be associated with a dentigerous cyst in a dog, hence histopathologic evaluation is needed to definitively diagnose dentigerous cysts and rule out a malignancy (12).

Treatment of dentigerous cysts includes creation of a larger mucoperiosteal flap, extraction of the associated tooth, and complete enucleation of the cyst lining (1,5). Curettage of the alveolar bone is recommended to increase the likelihood of success, although recurrence is uncommon (4,6,8–11). Enucleation of large dentigerous cysts comes with the risk of damage to neurovascular structures and/or pathologic fractures (6). In these cases, marsupialization of the cyst can be done to allow decompression and reduction in the cyst followed by enucleation at a subsequent surgery (2,6,9). It has been recommended to follow up on these cases for a minimum of 2 y or until there is radiographic evidence of complete re-ossification of the cyst (2).

Although dentigerous cysts are considered to be uncommon, they can be locally destructive and potentially undergo neoplastic transformation. A dentigerous cyst is always associated with an embedded or impacted tooth, and it is of utmost importance that veterinarians perform intraoral radiographs when teeth are missing from the pet’s occlusion. When detected early, dentigerous cysts are less difficult to surgically manage and they are best treated before they cause localized damage to surrounding teeth and tissues.

References

YOu care for them. We care for you and your practice.

A dedicated team offering appraisal, consulting and brokerage services. Call us at (888) 764-4145 or email vet@roicorp.com.

You care for them.
We care for you
And your practice.

Animal Health Laboratory

Full service veterinary diagnostics. State of the art testing and in-house veterinary specialists to provide optimal services to you.

“Working for animal health”

Guelph (519) 824-4120 ext. 54530
Kemptville (813) 258-8320
Email ahlinfo@uoguelph.ca
Website www.ahl.uoguelph.ca

WARD & UPTIGROVE
CHARTERED PROFESSIONAL ACCOUNTANTS

DAVE LEGAULT | DAVEL@W-U.ON.CA | 519.291.3040 | WARDANDUPTIGROVE.COM

YOUR SUCCESS IS OUR BUSINESS
Committed to helping you achieve financial success in your veterinary practice

Your Canadian Leader for Autogenous Biologics

Experts in Autogenous Bacterins and Swine Influenza Virus Vaccines

“See you in Banff”

For more information, contact: Sam Mostafa
Phone: 1-888-832-5223
e-mail: sameh@gallantcustomlaboratories.com
www.gallantcustomlaboratories.com

X-Ray Digital & Analog Ultrasound
ElectroSurgery & Laser Autoclave, Centrifuge & Microscope
Procedure & Surgery Light Vital Sign Monitor
IV Pump & Warmer
Anesthesia & Surgery Accessories
Stainless Steel & Veterinary Table
Dental Unit & Dental X-Ray

WARD & UPTIGROVE
CHARTERED PROFESSIONAL ACCOUNTANTS

DAVE LEGAULT | DAVEL@W-U.ON.CA | 519.291.3040 | WARDANDUPTIGROVE.COM

YOUR SUCCESS IS OUR BUSINESS
Committed to helping you achieve financial success in your veterinary practice

Your Canadian Leader for Autogenous Biologics

Experts in Autogenous Bacterins and Swine Influenza Virus Vaccines

“See you in Banff”

For more information, contact: Sam Mostafa
Phone: 1-888-832-5223
e-mail: sameh@gallantcustomlaboratories.com
www.gallantcustomlaboratories.com
Business Directory

**DOUGLAS C. JACK – Counsel**

- Practice Management Agreements
- Incorporations
- Employment Matters
- Discipline Proceedings and Malpractice Defence
- Buying and Selling a Practice

P 416.367.6389  |  TF 800.563.2595
F 416.367.6749  |  djack@blg.com
Bay Adelaide Centre, East Tower
22 Adelaide St W, Toronto, ON
Canada M5H 4E3

**TERRY JACKSON, C.P.A. - C.G.A.**

Phone: 604.939.2323  t.jackson@jandacga.com

**ERIC HOFFMANN**

T 514 695 4114  F 514 695 4926  C 514 889 1580
E eric@uxr.ca  W www.uxr.ca
227G Brunswick Blvd., Pointe-Claire, QC H9R 4X5

**PRACTICE ONE CONSULTING**

Practice Valuations  ♦  Practice Purchase
Practice Sale  ♦  Practice Management

**Dr. Frank Richardson, DVM, MBA**

*Veterinary Management Consultant*

P.O. Box 176  Phone: (902) 531-2617
Western Shore, Nova Scotia  E-mail: frank.richardsonvm@gmail.com
B0J 3M0  Fax: (902) 531-2618
"I was greatly impressed by the conference. I feel my future endeavors are attainable."

-2016 Women’s Veterinary Summit Participant

A unique two-day event, featuring keynote speakers, workshops and a personal review to discover individual behaviors and values, and explore strategies to achieve short and long-term goals. Participants will leave with a personalized playbook for life, and a network of resources for support.

Register at wvc.org
Treat CKD earlier to keep mature cats healthier, longer

Early-stage CKD can be hard to detect, but early treatment is now easier! Semintra® is the first-ever ARB licensed for use in cats with signs consistent with CKD. Semintra® targets the cause of CKD, not just the symptoms.

A NEW WAY FORWARD IN CKD.

ARB = angiotensin receptor blocker; CKD = chronic kidney disease
Semintra® is a registered trademark of Boehringer Ingelheim Vetmedica GmbH, used under license.
© 2017 Boehringer Ingelheim (Canada) Ltd.